Serfoji Rajah · 1829

THE

COMMERCIAL POWER

OF

GREAT BRITAIN;

EXHIBITING

A COMPLETE VIEW OF THE PUBLIC WORKS OF THIS COUNTRY.

UNDER THE SEVERAL HEADS OF

STREETS, ROADS, CANALS, AQUEDUCTS, BRIDGES, COASTS, AND MARITIME PORTS.

BY THE BARON DUPIN,
MEMBER OF THE INSTITUTE OF FRANCE,
&c. &c. &c.

TRANSLATED FROM THE FRENCH.

IN TWO VOLUMES,

WITH

A QUARTO ATLAS OF PLANS, ELEVATIONS, &c

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THE

COMMERCIAL POWER

OF

GREAT BRITAIN.

COASTS AND PORTS.

BOOK I.—LONDON.

Chapter I.—*General Remarks.*

WE have already treated of the roads, canals, and bridges of Great Britain; we have explained the laws relating to these objects, and their mode of administration; and we have described the works connected with them, and more especially those erections which are worthy of being imitated by our own engineers. In a word, we have taken a survey of the whole of the commercial communications which, during the last sixty years, have been opened in the interior of England. We have now to describe the maritime outlets of these internal channels of commerce.

We will begin with the most important of all the British ports,—London. We will descend the

Thames, in order to follow the eastern coast, both of England and Scotland, as far as the Orkneys; we will then take the range of the western coast, return along the southern to the mouth of the Thames, and re-ascend this river, coasting along the southern side, till we reach the point from which we started.

London is, at one and the same time, the metropolis of the empire, and the centre of the interior, as well as exterior, commerce of England. It is from the concurrence of these three causes that, at the present day, this city is necessarily the richest, the most extensive, and the most populous of all the cities of the old world.

This capital may be considered as the union of four distinct towns, differing essentially from each other, both with respect to the habits and occupations of the inhabitants. In the *western town* are situated the palaces, the houses of parliament, the courts of justice, and the residences of the ministers: here was the monastery of the west,—Westminster; here dwell the high officers of government, the nobility, and the great landed proprietors; here the rich heads of the mercantile interest daily retire to display their pomp, and enjoy their opulence, after having transacted their business in the *eastern town*, or city, properly so called. The city, the mercantile quarter of the metropolis, extends from the confines of Westminster to the vicinity of London Bridge, At this point commences the port of Lon-

dcn, the length of which is very considerable, and which forms the *eastern town.* These three towns extend on the northern side of the Thames; on the opposite side lies the *southern town*, which, from its very situation, takes the name of *Southwark.* In this place the industry of manufacturers principally flourishes, because here they are not subject to the restrictions imposed by the city companies.

If we were to cut off from London the eastern or maritime town, this capital would be scarcely superior to Paris, either in extent or in population; and if Paris, like London, could be rendered a maritime town, the capital of France would soon become equal, both in riches and extent, to the metropolis of the British empire; and such is the great object towards which we ought to tend*.

A remarkable change in the central town or city

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* We should be most happy to see this patriotic wish of our author accomplished, because we are satisfied that the advancement of our neighbour's prosperity must also advance our own. But we cannot understand how the obstacles which nature has imposed to Paris becoming a *maritime* city are to be overcome. The course of the Seine to Paris is 150 miles from its junction with the sea;—if its restricted width and the want of tide were not obstacles, the bridges which continually cross it would prevent the passage of large vessels. No ship can ascend the Seine higher than Rouen; and we understand that no very large vessels can even accomplish that ascent. If Paris were to be made the centre of a great canal communication with the interior, we do not see how the object which M. Dupin has at heart would be materially advanced. Of course France might establish a great maritime city—a rival of Liverpool—but Paris *could* not be that city.—*Translator*.

of London, is the decrease of its population. Within the ancient limits (*intra muros,*) this population at present is only two-fifths of what it was at the beginning of the 18th century. This diminution may be traced, in the first place, to the great enlargement of the streets since that period. But this reason is by no means sufficient, and we must seek in other causes for a more satisfactory explanation of this decrease.

In proportion as opulence increased and commerce took a wider range, the inhabitants of the city desired less confined residences. The rich, abandoning to their agents their old, dark, close, and smoky houses, began to inhabit the western town,—more spacious, more airy, more elegant, and the only fit abode of the fashionable world. For fashion, that capricious goddess whom foreigners depict under forms and graces altogether French, because with us she assumes a more pleasing aspect than elsewhere,—fashion exercises a more despotic sway in Great Britain than in any other country, and extends her influence more widely over the common usages of life. At Paris, a well bred woman, or well educated man, do not cease to be considered as *gens comme il faut,* and to be received according to their merit and agreeable manners, whether they inhabit the *Marais* or the *Fauxbourg Saint-Germain,* the *Isle Saint-Louis,* or the *Chaussée-d'Antin.* But, London, every individual who does not reside on the left bank of the river, and to the west of

Somerset-house, can lay no claim to mingle in fashionable circles; his name is erased from the catalogue of society, *par excellence.* This absurd prejudice has been sufficient to induce the wealthy merchant to quit the centre of his business, and to take up his residence at a great distance from his counting-house.

Whilst fashion was acquiring such an ascendancy, the progress of commerce brought about other changes in the city. Larger shops and more extensive warehouses were found to be necessary; while, thanks to the division of labour and the activity of individuals, an activity always increasing in proportion as commerce itself increases,—fewer hands have been required to execute a larger portion of work in a given time. The great number of new establishments erected in the maritime town and in Southwark, have drawn thither great numbers of clerks and workmen from the city.

Westminster, and what is called its "liberties," have experienced but a very inconsiderable increase of population for the last hundred years; this city being neither manufacturing nor commercial, its enlargement could not be otherwise than limited. Many portions of waste land were contained within its liberties, which have been built upon to correspond to the increase of its own population during a century, as well as to supply the demands of those families which came from the city to reside there. The number of inhabitants upon that part which was

anciently covered with houses has diminished; because the same increase of opulence which influenced the merchants of the city in their change of dwelling, has induced the wealthier inhabitants of this place to quit it for more spacious and fashionable residences.

But, though ancient Westminster has remained almost stationary—though the city itself has seen its population rapidly decrease—yet the other parts of the capital have increased to such an extent, that the population of the British metropolis has nearly doubled itself since the middle of the last century. The population amounted, at that period, to 676,050 inhabitants, while at present it exceeds twelve hundred thousand.

It is a matter of surprise that, from 1700 to 1750, the capital had not experienced an increase of two thousand individuals. It is since the year 1750 that London has advanced in the number of her inhabitants. It is since that period also, that the English have made their great improvements in the useful arts, and have established those works of internal communication so indispensable to the well-being of commerce. In the same manner shall we see the population and opulence of Paris increase, in proportion as we call into activity the resources of our industry, by completing and improving the commercial roads and means of communication which connect the capital with the whole territory of France.

London stands in a position so favourable to that commerce from which it derives so many advantages, that, whenever the traffic of England has found a fit moment to acquire a new impulse, the metropolis has always increased with great rapidity.

The uneasiness with which the British Government for a long time viewed the natural extension of its capital, may be considered as a very remarkable phenomenon in the history of politics. Instead of regarding this extension, the natural result of increasing riches and increasing population, as a certain sign of the commercial prosperity of the kingdom, it was once considered in the same point of view as the vegetation of those parasitical plants which nourish themselves by the exhaustion of the trunk upon which they multiply *.

In 1580 Queen Elizabeth published a proclamation, ordaining that a stop should be put to the farther increase of London. Actuated by the same views, James I., in 1618, opposed the extension of the capital. Cromwell does not appear to have been more enlightened upon this subject, since, in 1656, he renewed the same trite complaints against an increase, which he ought rather to have applauded.

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* We see from the ordinances of our kings, that in the 17th and 18th centuries the French Government entertained the same prejudices. An attempt was made to institute measures of police, to prevent the increase of the capital; an increase which those in power should have looked upon with just feelings of pride, as a striking proof of the prosperity of the kingdom.

In 1674 Charles II., by an order of council, decreed that such persons as were building, or even who *had built* upon new foundations in the suburbs and vicinity of London should be prosecuted. So imperfect were the ideas entertained at these periods with respect to the rights of property! The result of these measures was only an imposition of fines upon the transgressors of the ordinance, which, in fact, amounted to nothing else than a judiciary tax levied upon the improvements of the metropolis.

London was considerably augmented in consequence of the union of England and Scotland at the beginning of the 18th century. The union of Great Britain and Ireland, at the beginning of the 19th, has necessarily exercised the same influence, though in a less sensible degree. The immense conquests that the British empire has made in every quarter of the globe, by affording a great number of individuals the means of making considerable fortunes abroad, which they afterwards return to enjoy in the mother country, have constantly contributed to the enlargement of the metropolis. In a word, all the causes of prosperity, both commercial and political, have had an influence upon this aggrandizement, against which, for more than a century and a half, the supreme authority had opposed itself in vain.

CHAPTER II.

Commercial Edifices of the City of London.

It is within the city that all the great edifices necessary for the operations of general commerce are situated; such as the Guildhall, the Exchange, the Bank, the Post Office, the East India House, and others. We will take a cursory view of these buildings. The first thing that strikes us is their extreme contiguity, so favourable to the convenience and despatch of commercial operations. Thus the Bank, the Post-Office, the Exchange, and the Mansion-House, may be almost said to be adjoining each other. Round these establishments a crowd of others are so grouped as to lie as near as possible to the central point of action of that commercial power, the impulse of which is felt in the most extreme parts of the world. Of this impulse we shall (in part IV.) attempt to measure the force and intensity.

CORPORATIONS.

The commercial industry of the city of London is sub-divided into forty-nine branches, which form so many corporations, enjoying at the same time, mercantile, municipal, and political rights, of a very extensive and important nature. Each of them has its common hall for the

transaction of business, as well as for festive occasions and public dinners, which must not be reckoned among the least serious part of their affairs.

Yet, anxious as are these corporations on the subject of their sensual pleasures, they derive a greater pride from their charitable spirit. It has been calculated that the sums expended by them in the relief of the indigent classes of the community, exceed 25,000*l.* per annum. On occasions, when subscriptions are opened, either for the relief of great misfortunes, for the public recompence of some meritorious citizen, or for the advancement of some undertaking that claims a general interest, the companies of London distinguish themselves by their prompt and generous contributions:—a noble employment of the riches acquired by industry and commerce!

Personages of the highest distinction, nay, even princes of the blood, esteem it as an honour to be, or, at least, are sensible of the advantages of being, members of the companies of the metropolis, in order to establish their popularity upon a broad and durable foundation.

An extreme importance is conferred on these associations, from the circumstance that no one can participate in the rights of the city, unless he be a member of some company. Among those of the greatest influence may be mentioned the Fishmongers' Company, the Merchant Tailors', the Ironmongers,' *&c*,

These corporations, whose union forms the civic

body of London, assemble to treat of the general affairs of the City in the ancient building, Guildhall, erected in 1411. Its very name, which implies hall of the *guild*, or corporation, indicates the purpose for which it is destined. This edifice, the Gothic style of whose architecture is at once grand and elegant, is adorned with monuments erected by the hand of commerce, in honour of illustrious warriors, magistrates, or citizens, who have deserved well of the City of London, and of their country in general. Here is placed the monument of the great Chatham, the inscription of which we have cited in the Introduction.

The citizens of London, in the assemblies of Guildhall, exercise the rights of electing the Common Council and the Members of Parliament for the City. Besides these privileges, the offices connected with the civic administration of justice can be filled only by members of the corporations. The City is divided into twenty-four districts, called *wards*: each of these wards is administered by an alderman; in the same manner as Paris is divided into twelve *arrondissemens*, administered by mayors. But the mayors of Paris are not privileged to assemble in order to treat of the general interests of the capital; a right which is possessed by the aldermen. They form the council at which the Lord Mayor presides,—the privileges of which resemble those of our ancient *prevôt des marchands*, only they are here more extensive. The aldermen and the

Lord Mayor are elected by the citizens, who always choose tradesmen to fulfil these municipal functions. In explaining the social state of Great Britain, we shall enter more into detail as to the advantages and inconveniences of this mode of organization. In this place we shall only say a few words upon the principal magistrate of the City.

The Lord Mayor has for his residence a splendid edifice, called the *Mansion House;* the entrance of which is by a majestic portico, formed of lofty Corinthian columns, supported by a sub-basement of considerable elevation. The interior corresponds with the magnificence of this entrance; and the splendid fêtes that are here given by the Lord Mayor are worthy of the place devoted to them. The city provides an annual sum exceeding 8000*l.* towards maintaining the dignity of the office of this magistrate; to which amount he himself adds a moiety, and in many cases a larger sum, from his private purse.

The Lord Mayor combines in his office, in many particulars, the functions of prefect, edile, and tribune of the people. Invested with authority for maintaining the public peace*, and for protecting the liberties of the citizens, he is at the same time without the power either of disturbing the general order, or of arresting the march of government;—

* The government has no power to send troops into the city, without the permission of the Lord Mayor.

still less has he the means of restricting the will of the legislature, to which every other authority yields obedience and respect.

COMMERCIAL ESTABLISHMENTS.

The Bank of England.—The foundations of this handsome structure were not laid till 1732. Successively enlarged in 1770 and 1789, to meet the increasing demands of financial transactions, it was not completed till 1804. It is a vast rectangular building, insulated by four streets. The central part, which formed the entire original building, is eighty feet in length; its façade is decorated by a colonade in the Ionic order, as well as the two wings, which are of a later construction. The fourth side presents an extensive line of massive and naked wall, which offers no other entrance than a carriage way, for the passage of the vehicles which enter *Bullion Court*. The interior of the Bank claims our admiration by its vast extent, and the variety of buildings and offices which it contains. Here, as in the Villa of Hadrian, one is surprised at finding a faithful imitation of various monuments of antiquity. Thus, the principal cashier's office is a copy of the temple of the sun and moon at Rome; Constantine's triumphal arch is reproduced, to serve as an entrance to the court on the Lothbury side, which is also remarkable for its sumptuous architecture, imitated from the porticoes

of Greece; and, yet, close to thes ebeautiful constructions, the lovers of the arts cannot behold without astonishment a variety of whimsical details, of fantastic ornaments, and of forms in the very worst taste.

Of the interior parts most worthy of admiration, we must mention the rotunda, which is surmounted by an elegant dome: it was here that the stockbrokers used to assemble before the erection of a special exchange for their use*: it still serves for the speculators in funds, and continues to be much frequented.

The Hall is a long room, of about seventy-eight

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* The STOCK-EXCHANGE (Capel-court, Bartholomew-lane, Throgmorton-street. This building was erected in 1801, by a subscription of the principal brokers, by transferable shares of 50*l.* each. None but those persons who are balloted for by an annual committee, and pay the sum of ten guineas on their election, are allowed to transact business in this place. By this means, those who speculate only upon the rising and falling of the funds are limited to the *Bank Rotunda*, of which we have spoken above.

In the hall of the Stock-Exchange there is always posted a list of *defaulters*, or those who have not paid up their differences in the transactions they have made in the funds, *who can never become members of the association.* On the eastern side of the hall is a small office for the commissioners charged with the redemption of the national debt. It is here that, precisely at noon, four times a week, they make their purchases in the funds.

The business transacted in the Stock-Exchange is exclusively that of the purchase and sale of government stock, exchequer-bills, East India bonds, and other public securities.

The AUCTION-MART, in Bartholomew-lane: this is contiguous to the Stock-Exchange, and serves for the sale of effects by public auction. It was built by Mr. Walters, and the plan and architecture have been much admired.

feet by thirty-nine, in the centre of which stands a statue of William III., the sovereign under whose reign the bank was established. Ranges of small *drawing offices,* which are separated by partitions raised breast high, are every instant accessible to the individuals who come with their checks to draw upon the bank. The administration of a French *bureau,* with all its *inaccessibilities,* would be startled at the view of this hall! It would not be less startled at the view of the offices at the Custom-house. In both these establishments, from nine in the morning to five in the afternoon, all the principal clerks and all the directors are equally accessible.

The ROYAL EXCHANGE is separated from the Bank by merely the breadth of a street. This edifice, which was built by Sir Thomas Gresham, in 1656, was destroyed in the great fire of 1665, and afterwards rebuilt with more magnificence*. Its form is rectangular: good taste cannot but disapprove of the mixture of Gothic and Roman architecture that prevails throughout the building, and yet the whole is not deficient either in grandeur or elegance. It is to be regretted that its exterior porticos are encumbered by shops and bulks. A bold and light tower has been recently built, which surmounts the principal entrance.

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* It cost 80,000*l.* sterling; it is built of handsome Portland stone.

The interior court* is surrounded by a Gothic colonnade. The statues of the sovereigns of England adorn this court; while those of the merchants Gresham and Bernard decorate the exterior portico. Where, in France, shall we find the statues of our most illustrious merchants?

Above the porticoes of the gallery which we have just described is a range of apartments appropriated to the celebrated office of maritime insurances, legally instituted under the name of the Royal Exchange, and commonly known by that of Lloyd's, derived from a coffee-house, which furnishes a hall where the subscribers meet. The admission to this society is 25*l.* sterling entrance, and an annual subscription of four guineas ever after. This money is appropriated to the purchase of journals, domestic and foreign, and to the current expenses of the society. In order to become a subscriber, the party must be proposed by six members, and be afterwards accepted by the managing committee. The establishment of insurances at Lloyd's has rendered signal services both to the commerce of the British empire, and to that of other states. The society has agents in most of the principal ports of all parts of the world; it makes public the events, both commercial and maritime, which it learns through their means; these accounts are received by the public

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* It is 144 feet long by 118 broad; its exterior is 203 feet by 170.

with a confidence which nothing for more than a century has tended to destroy.

The Corn and Coal Companies have also their separate *Halls;* the first, under the name of the Corn Exchange, is situated in Mark-lane; the second, under the name of the Coal Exchange, stands in Thames-street.

Commercial Hall.—This is a building destined for the public sale of colonial produce, such as cotton, indigo, tobacco, sugar, coffee, *&c.* It is composed of two distinct wings. There are show-rooms, divided into a great number of stalls, for the display of various articles; there are also meeting-rooms, sale-rooms, *&c.*

We shall not speak of the common markets for the sale of the necessaries of life. Though less wretched in appearance than our ancient markets, yet they can bear no comparison with those that, within these few years, have been established in the capital of France: indeed the latter are the finest in Europe.

HOUSES AND WAREHOUSES OF INCORPORATED COMPANIES.

The greater part of these stand in the city. The most important is, that of the East India Company. It is situated in the street which immediately leads

to the exchange, and was built in 1726; it was more recently decorated with a façade in free-stone. In the centre of this façade is a portico composed of six columns of the Ionic order, above which is a pediment containing various emblematical figures. They represent the commerce of the company as protected by Geo. III. On the summit of the pediment is the statue of Britannia; on the eastern angle is that of Asia, seated upon a dromedary, and on the western, that of Europe. The interior of the edifice bespeaks the grandeur and glory of an association that rules over eighty millions of subjects. Here are preserved in the library, the arms, and the canopy of Tippoo Saib, the golden head of a lion that decorated his throne, the trophies captured by General Harris at Seringapatam, &c.

In New-street, Bishopsgate, not far from the East India House, stands an extensive range of buildings which serve as warehouses for the products which the company imports from Asia. The officers who have the care and superintendence of these warehouses are lodged in two handsome houses at the extremity of this building. The company occupies many other storehouses and cellars, which they hire according to the varying demands of their commerce, independently of the docks and warehouses we are shortly about to describe.

SOUTH-SEA COMPANY.

We have just visited the establishments of a mercantile society, whose wealth and prosperity have risen to the greatest height, and by means the most constant and unfailing. We now mention the hall of a company whose prosperity was as scandalous as it was ephemeral; because it had none of those principles for its basis, which alone can ensure the success of commercial associations. At present, the South-sea Company is nothing more than a financial corporation. It conducts its affairs in a large and handsome house in Threadneedle-street.

FIRE INSURANCE OFFICES, &c.

These are establishments in which persons may insure their houses, goods, or other property against fire, and other accidents which it is possible to submit to the calculation of probabilities, in estimating the proportion of chances on the average of a great number of events. These establishments belong to companies; the greater number of them are situated in the city, though some are found in other parts of the capital. We have already spoken of the insurance company of the Royal Exchange, whose office is at that place. It is formed into a corporation by a royal charter, as well as the companies distinguished by the name of the London and Globe

Insurances*. The Royal Exchange and the London are the only companies that are empowered to insure vessels: a great number of maritime insurances are made by individual capitalists.

Among the insurance offices we must first notice that which is called the HAND-IN-HAND, in Bridge-street Blackfriars, as being the first of the kind instituted. It was formed in 1696; afterwards was founded that of the PHŒNIX, in 1706, which was the first to insure goods and merchandise. There are many other companies whose object is likewise the insurance against fire;—others confine themselves to insurance upon lives and survivorships. The greater part of the buildings that serve for their offices, are distinguishable from ordinary houses by their porticoes with columns, and their stone façades. At the top of the beautiful street that faces Carlton Palace, stands the COUNTY FIRE OFFICE; the architecture of which produces a happy effect.

The insurance companies have, with respect to commerce as well as property, very remarkable consequences, the theory of which we shall explain when we come to treat of the productive power of Great Britain.

WATER COMPANIES.

There are six grand companies formed for

* The first is established in Birchin-lane; the second in Cornhill, and Pall Mall.

conveying and distributing to the inhabitants of London the water necessary for the common wants of life. The most ancient is that of the New River, established for upwards of two centuries. The waters, on reaching the reservoir, are found to be eighty-five feet above the level of the Thames; they are raised still thirty-five feet and a half higher by means of steam. Hence the water is conducted by pipes to the upper floors of the highest houses. That portion of the pipes which was laid in the streets, was formerly of wood; in proportion as they become no longer fit for service, they are replaced by iron pipes. The New River Company alone furnishes 13,482,000 pints of water every twenty-four hours, at the rate of two shillings for every 6,300 pints.

The other companies are known under the names of the Grand Junction, at Paddington; of the London Bridge; the East London; the South London; and the West Middlesex. Their names themselves indicate their position. According to a grand principle of political economy, we should be led to believe that their number would, at least, keep their rate of charge moderate; but as these companies are not ignorant of the principles of monopoly, they seem to have united in order to sell their water equally dear. This deprives the inhabitants of all means of obtaining it at a lower rate, by giving the preference to one company above another.

A new branch of industry has recently sprung up, to call forth the speculations of a number of companies throughout the whole of Great Britain; this is the mode of lighting by gas. The first company instituted for this kind of lighting, under the title of the Gas and Coke Company, possesses three great establishments in the west, east, and north of the metropolis, *viz.*, in Peter-street, Westminster; Norton Falgate, and Brick-lane. Two other companies have been since formed in the southern town. We have given some details of companies of this kind in the first and second books of the preceding volume.

GOVERNMENT COMMERCIAL BUILDINGS.

The Post-Office. — This is a building without architectural pretension, erected in a narrow and winding street, leading from the Mansion House. It is intended to remove this establishment to a spot near St. Paul's Cathedral, where it is to be built on a more extended and better-arranged plan. But, something much more important than a mere regard to architectural arrangement, is the order established in the service, which regulates the arrival and departure of the mails, the mode of forwarding letters, and their reception and distribution. In these respects, the English have attained to a degree of regularity and promptitude which deserve to be cited as models, and which powerfully contribute to the certainty and despatch of the operations

of commerce. This is a point which we shall consider when treating of *circulation.*

Customs.—In the month of February, 1814, the old Custom House was consumed by fire. All the accounts relative to this species of service, which were not then closed, and consequently had not been laid either before the Treasury or Parliament, were destroyed;—a circumstance that leaves a sad gap in the statistical documents relative to the navigation and commerce of the British empire, during the year 1813, and a part of 1814.

The new Custom House, completed in 1817, is remarkable for the grandeur and regularity of its architecture*. The façade, which fronts the Thames, produces a very striking effect: it is ornamented by two bas-reliefs. That to the east represents the arts and sciences united, in order to promote the interests of industry and commerce. That to the west represents the varied costume and characteristic emblems of the different countries with which England has commercial intercourse. In the centre of the façade is an inscription in bronze letters, bearing the names of the founders of the building, and the date of its erection: higher up is a dial, supported by two colossal figures, representing industry and plenty. The ground floor *has a pro-*

* It is 480 feet by 108, and cost 167,050*l.* sterling. This building was designed by Mr. David Laing.

jecting flight of steps, leading to a central entrance, opening to the warehouses: above this entrance are the Royal Arms, supported by statues emblematical of the ocean and of commerce.

In front of the façade is a spacious quay, along which, at high water, the vessels that come to load or unload find a depth of water equal to nearly twenty feet. It is proposed to extend this quay to the tower on one side, and to London Bridge on the other.

The ground-floor is composed of the warehouses of the customs, of the offices of the inspectors of the river, gaugers of ships, boat registrars, &c.

The upper-floors are divided into a great number of apartments containing the particular offices of the customs of the port of London, as well as of the general customs of Great Britain.

In the centre of the establishment is a hall, one hundred and ninety feet long, sixty-four broad, and fifty-five high, which is divided into three compartments by massive pillars, which support three separate domes, which are all richly ornamented. This vast hall is warmed and ventilated according to a very ingenious process. Throughout the whole of the edifice, the most remarkable precautions have been taken against any possible accident by fire. The doors which separate the principal divisions of the interior are of iron; they are so formed as to slide into the walls, from which, when required, they can easily be drawn by means of a sort of windlass. During the night these doors are closed; the same can be done

in case of fire, to prevent the flames from extending to the parts of the building which they insulate. On each floor, the rooms appropriated to the reception of the valuable papers of the establishment, are formed of incombustible materials. The registers are every night deposited in iron chests.

Trinity House.—This establishment is for the administration of the pilotage of the Thames and of the seas to the south of Great Britain. It is situated in the open space that surrounds the tower of London. The building is not very spacious, but it is distinguished by the elegant simplicity of its architecture. It was built after the plans of Mr. Wyatt.

The corporation to which this building belongs, was instituted by Henry VIII., and its title awakens recollections of the theological ideas of this tyrannical reformer:—The masters, wardens, and assistants of the corporation, or brotherhood of the most glorious and indivisible Trinity, and of St. Clement, in the parish of Deptford-Stroud, in the county of Kent*.

The duty of this corporation is to watch over the

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* The affairs of the corporation are transacted in London, though the original establishment, called the *parent-house*, is at Deptford. This corporation consists of a master, four wardens, eight assistants, eighteen elders, and a great number of younger brethren. The latter take no part in the affairs of the corporation. The elders are generally captains in the navy, or of merchant vessels.

interests of the British navigation, both warlike and mercantile. In this respect, it possesses very extensive powers, the principal of which are the following:—to examine the pupils in the mathematical classes of Christ's Hospital; to examine the masters of all vessels; to appoint pilots for the Thames; to erect light-houses and signals for pilots along the coast; to grant licenses to poor mariners, who do not enjoy the freedom of the city, to ferry upon the Thames; to direct the cleansing and deepening the bed of the river, *&c.* Whenever the corporation learns that some bank of sand or other obstruction is forming in the river, it despatches its workmen and ballasting-boats to labour at the same till it be completely removed. This corporation enjoys the exclusive privilege of furnishing the vessels that navigate the Thames with their necessary ballast, a privilege from which it derives very large profits. In fine, it is allowed to receive charitable donations; hence, every year it succours a great number of indigent mariners.

CHAPTER III.

The Port of London.

THE establishments of the commercial shipping being immediately below London Bridge, vessels not being able to advance farther up the river are ranged on each side of the stream, in rows of five, six, and even seven deep, in an extent of line of about 8750 yards. In this vast extent, the Thames is, in many places, sufficiently deep to allow the greater part of the vessels to remain afloat even at low water. In the middle of the river a wide space is always left open, even when the port is most frequented, that vessels may have a free passage to sail up or down, whatever be their point of arrival or departure. The traveller, however his mind may have been prepared, and his imagination warmed, by splendid descriptions of the majesty of this spectacle, finds the reality still far beyond his expectations. On the other hand, he is disagreeably surprised, when, instead of spacious quays, bordered by regular ranges of lofty warehouses and sumptuous edifices adapted to every branch of an universal commerce, he sees the river confined by ungainly walls, and palings, and clumsy piles; the whole surmounted by smoky and irregular sheds

and houses that cover these filthy banks, without even leaving a free path by the water-side for foot-passengers.

Miserable, however, and offensive to the eye as this view is, it is compensated by certain advantages. If carts and waggons are unable to reach the side, in order to bring and carry away the cargoes of vessels, yet these vessels themselves, on reaching the quay, have their decks immediately under the cranes and pullies with which these warehouses are furnished, so that goods are at once shipped and unshipped to and from their peculiar depositaries. These warehouses are themselves the depôts into which the products of nature and art pour from all quarters of the globe, to be afterwards distributed into the heart of the capital and the provinces.

For many years past the Parliament has been engaged in the consideration of the best means of improving and embellishing the quays of the Thames. The most eligible of a variety of plans for this purpose have been received and remunerated by the Treasury, but no definitive choice has yet been made. In great measures of general utility the British Senate thinks it can never proceed with too great prudence and deliberation, in order that sufficient time may be allowed to every one for the due examination and discussion of the subject, both for the completeness of the public object, and the security of private rights. Whenever any plan, either

for the change or the improvement of an object of public interest, is proposed to the Legislature either by an individual or a company, it is almost always taken into consideration. The openness of this first step at once awakens public attention. The individuals or companies in whose favour the project is likely to operate assemble in order to demonstrate its utility, in petitions wherein its present and future advantages are stated under every point of view. On the other side, the companies or individuals to whom the same project might prove detrimental unite their efforts to oppose it. They place in the strongest light the inconveniences they are likely to suffer from it, and every argument that is calculated to retard the success of their antagonists. This contest is begun and carried on with an ardour and a selfishness that are scarcely credible. Each party, believing itself called upon to look exclusively to its own cause, defends it with admirable talent, energy, and perseverance. Every petitioner finds in Parliament, either in a Member of his own county or town, or one bound to his own political party, a protector, who, to the cold reasonings detailed in the petition, undertakes to add the more forcible powers of his eloquence. When the documents of a particular measure are presented and supported in Parliament, they are immediately intrusted to a committee, which is charged with the examination of the whole details, as we have already explained with respect to the projects of canals. This com-

mittee consults the most celebrated professional men, versed in the particular branches of art or science under consideration; it considers the different bearings of the question in a statistical point of view; it balances the various arguments; it verifies the assertions and facts advanced on either side of the question; and lastly, it draws up a report to be laid before the House, which is generally in a very clear and simple style, befitting subjects of importance thus analyzed for legislative consideration. Nothing is neglected that can tend to throw any light upon the project submitted to their deliberation. This immense labour is almost always made public, whereby the parties interested are furnished with the means of making a reply. In a word, when the question regards some object of great moment, it is only after a second, and sometimes even a third report, that the Parliament, fully instructed on every point of the reports themselves, by the light arising from the debates on the subject, votes upon the question which it has thus fathomed with so much prudence and scrupulous care.

The project being once approved, and the plan of the works determined upon, to the former slowness in deliberation succeeds activity and despatch in the execution; and the greatest enterprises are brought to a conclusion in a space of time, the shortness of which is not less astonishing than the immensity of the labours and of the genius which triumphs over obstacles without number.

Thus it is that, by applying the solemn forms of deliberative assemblies to the examination and discussion of every species of public good, and by directing the noble right of petition, not towards recriminations and objects of a personal nature, but to those of general utility, prudence of deliberation, publicity of measures, and that justice which such publicity commands, are united with the experience of the scientific, of artists, and of practical men, as well as with the powerful activity of rich capitalists, who are ever anxious to employ their funds in a manner the most likely to prove productive.

By following such a course presented by wisdom itself, the British Parliament has, since the close of the last century, sanctioned the infinitely important improvements that have taken place in the police and commerce of the Thames. It is scarcely twenty years since nearly the whole of the vessels that entered this port were obliged to remain moored in the open stream of the river. The small Greenland basin served only for some few vessels destined for the fishery upon the coast whose name it bears. The ships were consequently jammed one upon the other, and a space of six miles in length by half a mile in breadth, was not sufficient for the vast concourse that assembled here. In the midst of this immense quantity of vessels, it was impossible to prevent great delay in working a ship, as well as fre-

quent damage. It was equally impossible to preserve perfect order of any kind; and to prevent not only frauds committed against the public revenue, but also depredations upon individual property on board the vessels. In the interesting work published by Colquhoun upon the police of the Thames, it will be seen to what an amazing extent the cunning and audacity of those depredators who preyed upon vessels of commerce was carried. They had a regular and ingenious organization, divided according to the nature of their arms, and the particular branch of the profession which they exercised. The *light horsemen* were destined for expeditions by night; the *heavy horsemen*, for those by day. There were brigades of thieves, coopers, smiths, breakers, cleavers, boat lifters, general receivers, *&c.* Every evening, detachments of these bodies were despatched to make an attack on such and such a vessel, at a certain fixed hour; and this act of depredation was carried into effect with all the unanimity, the silence, the promptitude, and the intrepidity of a military enterprise.

The example which, for more than a century, had been set by the port of Liverpool, pointed out to the metropolis the true remedy for these evils which retarded the prosperity of commerce, and vitiated in their very source the morals of a numerous class of citizens. A resolution was formed in London to have basins sufficiently large to con-

tain vessels laden with the more precious products, which would have the two-fold advantage of placing such products beyond the reach of depredators, and of rendering of more easy and effectual application to the vessels themselves, the efforts of a police which had been instituted with a view to put a stop to such a system of robbery.

CHAPTER IV.

Docks, Buildings, Yards, &c.

By the term *dock*, derived from the Greek δοχεῖον, a *receptacle*, the English understand a basin in which vessels are kept afloat. They call those places in which vessels lie, dry *Graving-docks.* Lastly, the term dock applies equally to stocks for the construction of vessels; hence the expression *Dock-yards,* which is appropriated to the yards that contain these stocks.

It was only in 1800 that those vast basins which have so much increased the commercial prosperity of the metropolis began first to be carried into execution. We shall give a description of them in the order in which they lie, in descending the course of the Thames. They are all situated on the northern side of the river. The first, called the London Docks, is just below the site of the tower, in a projecting elbow of the river. After more than three years of examination and discussion, an Act of Parliament, dated the 20th of June, 1800, authorized a company to erect this magnificent establishment. We shall give an outline of the principal provisions of this act; they may serve as a basis for the companies which may hereafter be instituted in our ports, for accelerating the prorgess of our commerce

The fund-holders have five per cent. annual interest guaranteed upon the capital which they advance; the dividends can never exceed ten per cent. The capital of the company shall be in the first instance 1,200,000*l.* sterling, and may be increased to 300,000*l.* more. The interest of the loans destined to complete this capital, shall be paid in preference to the dividend. The proprietors of from 500*l.* to 1,000*l.*, 1,000*l.* to 5,000*l.*, 5,000*l.* to 10,000*l.*, 10,000*l.* and upwards have one, two, three votes, in their respective proportion.

Thus no one can have more than four votes in the general meetings. In case the number of votes is equal, the president has a casting voice. In order to vote, it is necessary to have been a share-holder twelve months. Nine proprietors are sufficient to call a general meeting, independent of the half-yearly meetings, for the examination of the current accounts.

After having laid down these preliminary bases, the act enumerates the parishes, and points out the particular spots, whether public or private property, on which the company may establish its dock, quays, and warehouses. It is authorized to treat for five years from the date of its establishment, for the purchase o land and buildings necessary for this purpose, and to have recourse to a jury, if a private arrangement is not found sufficient.

The company is empowered to enclose its establishment with a line of wall; to supply its basins with the waters of the Thames; to construct bridges wherever the further communication requires it, and to lay down pipes and provide sewers, subject to the superintendence of the Commissioners of Sewers.

The company engaged to complete the works in seven years, and the progress was directed to be annually laid before Parliament, by the managing committee.

The company is bound to preserve a certain depth of the river before the entrance of the dock. It is prohibited from building vessels.

The dock rate is thus fixed at per ton, according to the official guaging of the ships: First, For every ship that traffics between

London and the ports of Great Britain and the Scottish Isles, 1*s.*; Second, Ireland, and the Isles of Man, Jersey, Guernsey, France, from Ushant to Dunkirk; the coasts of Flanders, Germany, and Denmark, as far as Elsineur, 1*s.* 3*d.*; Third, North of Elsineur, and to the Baltic, 1*s.* 6*d.*; Fourth South of Ushant to Cape St. Vincent, Newfoundland, the Canaries, the Azores, 1*s.* 9*d.*: Fifth, Europe to the south of Cape St. Vincent, the Mediterranean, Africa, the two Americas, the South Sea Fisheries, 2*s.*; Sixth, The East Indies, and eastern Asia, *&c.*, 2*s.* 6*d.*

The merchandise shipped or unshipped within the docks, pays a duty which is not to exceed the current rate of 1798, in the port of London, for anchorage, moorage, housing, *&c.* The officrse of customs are not to give a certificate of discharge to the captains of vessels but upon view of a receipt for dues to the dock-company, regularly delivered by the officers of this company.

Every vessel that arrives laden with more than twenty pipes of wine or brandy is obliged to enter the London docks. If laden with fruit, it can, previously to entering the docks, land its cargo any where else. A vessel may remain six weeks to unlade in the docks, and two weeks longer by paying one farthing per ton; for every week beyond this period, a halfpenny per ton is paid.

The directors appoint a dock-master to superintend the entrance, station, moorage, and departure of vessels. The act specifies a variety of precautions against fire on board of ships. Every individual who wilfully sets fire to or endamages any vessel or its cargo, or any other property within the enclosure of the docks, incurs the penalty of death without benefit of clergy.

Of the various fines levied upon those who infringe the company's regulations, those which exceed 40 shillings are paid into the company's funds. Those under 40 shillings are to be thus divided:—a third to the fund of sailors, belonging to the merchants' service; a third to watermen disabled in the service of the London docks; a third to the watchmen and servants of the dock, who are incapacitated in a similar way.

We will now proceed to describe the place itself. The London-Dock (the larger) is a rectangle, the longer sides of which run from east to west. The lower entrance is by a cut which opens into a long basin, communicating with the dock by a short canal: this is called the Wapping entrance. Higher up the river there is another canal which leads to the south-west angle of the dock: this is the entrance called the Hermitage, of which we give a plan, with the excellent locks by which it is closed. For this plan I am indebted to my old friend Mr. J. Rennie, whom I had the misfortune to lose during my last visit to England.

Mr. Rennie was the engineer who prepared the plans, and directed the execution of the great works of the London Dock. To form an idea of the importance of these works, it will be sufficient to detail some of the principal dimensions:

The Dock, properly so called, is 420 yards in length, 276 yards in breadth, and 29 feet in depth; its superficies is equal to 25 acres, that of the basin is above two and a half acres, and if to this space be added the ground occupied by the warehouses, the sheds and the quays, it will be found that the whole premises contain a superficies of 110 acres.

With the exception of those ships that trade to the East and West Indies, every vessel, whether English or foreign, may enter the London Dock, upon paying the duties, to unship their cargoes, or take in a new lading.

For the convenience of business ranges of sheds, low, and of a very simple construction, have been erected along the sides of the dock and near the edges of the quays, into which the cargoes are

removed. Behind these sheds, and in a parallel direction to them, stands a line of magnificent warehouses, four stories high, with spacious vaults, into which the casks are conveyed by inclined planes. These warehouses are built with regularity and solidity, but without any pretensions to ornament. Nothing, however, can be more imposing than the effect of the whole, of the grandeur of which some idea may be formed, by considering that these buildings occupy a superficies of 120,000 square yards.

In front of the warehouses, and along the whole length of the sheds, are iron railways; others cross these at right angles, leading from the quay to the warehouses, and, in some instances, to their interior. Oblique lines of connexion facilitate the communication of the former rail-ways with the latter.

As the edges of these rail-ways rise in a small degree only above the level of the pavement, carriages can pass over without damaging them, and without being impeded by them.

To the east of the dock a range of warehouses has been built for the reception of tobacco. Before this expensive production was stored in secure places, and defended by high walls, it was a great object of the system of plunder and fraud, carried on upon the river. The finest and most extensive of these warehouses, which of itself covers a space of six acres is the work of Mr. Alexander. This distinguished architect has here made a most judicious combination of wood and iron *.

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* Pillars of cast-iron, placed at equal intervals, and ranged in parallel lines, also equidistant, present a succession of colonnades, surmounted by iron arches of a very singular form. These arches go off in pairs from the two contiguous columns; they are equally inclined upon the plan, the one towards the right and the other towards the left of a plane passing through the axis of the two columns: they have the form of hyperboles, the summit of which would be the upper point of the arc. The summit supports the beam, which, passing perpendicularly upon it, at the same time holds it in its place. These beams are the raising-plates of two roofs which are equally inclined, though in opposite directions,

On the other side of a short canal, and close to this warehouse, is a second which covers above 17,000 square yards.

Its construction is evidently upon the same principle as the last-mentioned. But in the present instance, the idea which Mr. Alexander afterwards followed up, is in some measure still rude, and the progress of art is very perceptible in a comparison of the two buildings*.

We have already stated, that the London Docks are the general depôt for wines and brandy. The pipes of wine and pieces of brandy are kept in the vaults, which occupy the same superficies as the warehouses; these vaults are groined, and their

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having their junction resting perpendicularly over the ranges of columns, which are hollow, and receive the waters of the gutter. This water is conveyed into the Thames by means of underground-pipes. The roof is composed of two distinct parts, the upper of which is separated from the lower by mullions, between which, a glazed aperture admits an oblique light, the rays of which pass under the principal beam, and give a sufficient illumination through the whole extent of the warehouse.

That part of the upper roof, from which the aforesaid mullions spring, presents a horizontal plane, formed by transverse beams, from the middle of which arise; 1st, a vertical prop going up to the ridge, and, by means of an iron stirrup, relieving a beam instead of pressing upon it; 2dly, from arcs-boutans passing diagonally from this point to the heads of the four mullions, which form a square round it. The execution of this shed is not less remarkable than its design.

* In one of these warehouses, stands a large furnace in which the leaves of the waste tobacco are burnt, from the ashes of which the alkali which they contain is collected.

piers serve as supports to the columns of the warehouses above. The visitors who come to view these vaults, are provided with lights, in the same manner as if they were about to descend the the catacombs of Naples or Rome*.

Having now explained the formation of the London Dock company, and its local arrangements, we shall proceed to give some account of the principles of its different works and machinery. Its works began about the close of 1800. A term of seven years was allowed for their completion, and in the January of 1805, the establishment was opened to merchant vessels; but the erection of the walls and the necks of the second entrance basin, required much more time. The cause of this delay arose from peculiar difficulties thrown in the way by the owners of certain houses, which it was necessary to pull down in order to form the quays of the entrance-basin†.

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* The lamps furnished for this purpose are of lead, and of a hemi-spherical form; they are affixed to a long handle, and can be inclined very consideraby without either extinguishing them or spilling the oil.

† During the work, a steam-engine was constantly employed in exhausting the waters that filtered into the excavation prepared for the entrance-basin. This machine, constructed by Watt and Boulton, was of twenty-horse power, and commonly raised nine yards cubic of water per minute, to the height of thirty-three feet; it consumed two bushels of coal an hour. This engine turns a drum bearing a long endless chain; this chain has a horizontal direction, and glides upon rollers in order that in no part it may be impeded

The locks of the London-Docks have all their parts perfectly adapted to each other, and are of the most admirable construction. The gates, like all those whose size exceeds from 20 to 23 feet, instead of being straight like ours, are curved on the side on which the water presses. This is the place to examine which of the two systems offers the greater advantages. With us, prejudice is decidedly in favour of straight gates. Hence, when in my "*Mémoires sur la Marine, et les Ponts et Chaussées de France et d'Angleterre,*" I appeared to give the preference to curved gates; some very skilful engineers at first pronounced against this opinion.

At a later period, however, the natural correctness of their judgments, and the results of experiment,—results which they were unwilling to believe upon my first assertion,—have led them to adopt this principle.

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by friction. It is received upon a second circular drum, which has an eccentric pin, the action of which causes the piston on a powerful pump to rise and fall alternately.

As the chain might become more or less lengthened by the extension or wear of its links, or by the variations of temperature, it was necessary so to contrive that it should constantly press with equal force upon both the drums, to receive the motion of the one and transmit it to the other. For this purpose, between two parallel uprights, between which the endless chain passed, a heavy roller, which mounts, descends, and turns freely upon a groove, presses upon the upper part of the chain. By this constant weight, whatever be the shaking of the machine, or the variations of the length and oscillations of the chain, still this chain exerts an equally constant tension upon the drums.

Another very important difference observable between the hydraulic architecture of the English, and that of the French, is the form of the walls of their quays. We give the exterior face of these walls, the straight form of an inclined plane; while the interior face, that which is in contact with the ground, is in the form of a vertical plane. The English give both these faces a curved form; beginning almost perpendicularly and without a curve at the upper part; the curvature increases and takes a sloping direction, which is less rapid as it approaches the lower courses of the work. In works executed with great care and precision, these courses, instead of being horizontal, are perpendicular to the exterior surface of the wall. (See plate.)

We shall, in succession, demonstrate the advantages of locks with convex gates, and quays with concave walls.

Belidor has attempted to compare the resistance of curved gates with that of straight ones *. I must confess I am somewhat surprised he should have fallen into such a theoretical error, as that upon which he rests his argument.

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* See Belidor's *Architecture Hydraulique*, liv. i. "Sur la perfection des écluses." M. Dupin has published, at full length, the passage in which he discusses this question, but we have not thought it necessary to give the translation of it.

We must in the first place point out their importance, both with regard to British commerce, and the capitalists to whom this magnificent establishment owes its origin, an establishment surpassing in grandeur and magnificence that of any other maritime city*.

On the banks of the Thames there is only a certain number of places where ships can load and unload; these are called *legal quays*, because their position has been determined by the legislature. Their extent has always been too limited. These quays being almost all of them private property, the owners have always exerted their personal influence to prevent the increase of their number; while, at the same time they coalesced to keep up the renting of them and of the warehouses as high as possible.

Such inconveniences, serious for vessels of every

* The management of the affairs of this company is intrusted to twenty-one directors, who must be share-holders to a considerable amount in the funds of the company; eight among them, at least, must belong to the corporation of the city of London. Annually, four new directors are elected in the room of an equal number going out of office; but every fifth year, five are elected and five go out, by which means the directors are entirely renewed in the space of five years. In January and July, a general meeting is held to proceed to elections, and to examine the state of the funds and the reports concerning the expenditure for keeping up and improving the establishment. Every shareholder is entitled to attend these meetings; but the right of voting is vested in those only who possess shares to the amount of at least 500*l.* sterling; the latter can vote by proxy.

description, were more particularly so to those laden with the rich produce of the West Indies. These vessels arrived in numerous fleets, which, all on a sudden, filled the port of London, and they could only approach slowly and in succession, to the places allotted for the landing of their cargoes; thus the most of them were unladen by lighters, at a great distance from the warehouses destined for the reception of colonial produce.

These multiplied obstacles, and the confusion to which they naturally gave rise, amidst a countless throng of vessels engaged in every description of commerce, facilitated depredations to a degree almost incredible, though unquestionable. According to the very circumstantial account submitted, in 1810, by my friend Mr. George Hibbert, to the general meeting of share-holders, it appears, that before the establishment of their docks the robberies committed every year upon the colonial produce which entered the port of London, exceeded the *hundredth* part of the indigo, cocoa, wines, logwood, ginger, *&c.;* the *fiftieth* of the sugars, and the *fortieth* of the rums! During the years 1799, 1800, and 1801, alone, these depredations amounted to a loss equal to 1,214,500*l.*! According to this calculation, and taking into account the increase of commerce, as well as the rise of colonial produce, for seven years, dating from the opening of the West India docks, the capital saved to British commerce amounts to 2,702,542*l.*, nearly one million of which

would have been lost to the revenue in the ancient order of things.

From the establishment of the docks, commerce has derived the advantages of a greater expedition in the unshipping of their merchandise, a more rapid sale, and a reduction of eighteen per cent. on the expenses of unloading and warehousing. The hulls of vessels moored in still water, and sheltered from the effects of the tides are better preserved, but especially their rigging and cables; whilst, on the other hand, these vessels are perfectly free from depredations, in a well guarded enclosure.

With respect to Government, they have gained not only the duties levied upon that great portion of the merchandise formerly smuggled, but they have also been able to reduce their expenditure, by employing a much smaller number of agents to collect the customs and excise duties, in docks well guarded, and in warehouses so spacious and regular, where each species of produce, subject to a different duty, is stored in a separate place.

But, in rendering these great and important services to commerce in general, to trading vessels, and to the public treasury, the West India Docks' Company have themselves acquired large profits; their original capital amounted to 500,000*l.*, they raised it to 1,200,000*l.* which returned an interest of ten per cent. The revenues of the company amounted in 1809 to 330,623*l.*; in 1813 to 449,421*l.*; in 1817 to 297,539*l.*; in 1819 to 248,770*l.*

Up to the year 1818 the company had accumulated nearly 800,000*l*, on their economies, which capital was left in reserve to cover future deficits. In the same year, having reduced the entry duties,* they were compelled to take a part of the above-mentioned sum, to make way for the deficit which this measure occasioned in the returns of the years 1818 and 1819, in order to pay the same dividend of ten per cent. to the share-holders—thus, from 1800 to 1817, the original capital, amounting to 1,200,000*l*. brought to the company an annual dividend of 120,000*l*. besides an economy of 800,000*l*.! We will now proceed to the description of the establishments from which such important results are derived.

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* The present rate is eight-pence per hundred weight of sugar; one penny per gallon for rum; one shilling and six-pence per hundred weight for coffee; two-shillings and sixpence per hundred weight for cotton, *&c.* The following is a detail of the expenditure of the establishment, for the year 1819, the total amount of which is 151,644*l*.

Workmen and servants	£50,124
Officers of the dock	21,300
Charities, donations to free schools . .	760
Invalids of the dock	516
Taxes	13,320
Fire insurances	1,209
Cooperage materials, *&c.*	16,766
Buildings and construction of road-ways .	21,111
Improvements and repairs . . .	19,025
Sundries	7,513
	151,644

The West India Docks are on the left bank of the Thames, at the distance of about one mile and a half below the London Docks; they are situated on the base of a tongue of land of the Isle of Dogs, a sort of peninsula formed by a long circuit of the river. The docks have an entrance at each extremity of this circuit. South of the docks and parallel to their length is the city canal, by means of which the long turn of the river may be avoided, as has been observed in describing the canals, of which London is the centre. Vol. I., Book 4, Chap. 4. But as in order to gain the advantage offered by the canal, a toll is to be paid, most Captains prefer following the common course of the river, which, when the tide serves, does not occasion a loss of more than two hours' time. It has been found more advantageous to make this canal serve as a receptacle for dismantled ships, laid up in ordinary; they are ranged on a line of about a mile in length, and present a magnificent sight, when viewed from the right bank of the river.

The West India docks are much superior to the London, both in extent and regularity*. These vast works have been undertaken and executed by an association of private individuals, and by means

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* M. Dupin, to give an idea to his countrymen of the magnitude of these docks, enters here into a comparison, which can be understood only by those who are thoroughly acquainted with the topography of Paris, and which it has therefore appeared to us unnecessary to translate.

of a mere subscription; twenty-seven months have sufficed to accomplish such prodigies. The excavations of the West India docks began on the 12th of July, 1800; and, as early as the month of September, 1802, vessels entered the import dock.

At the highest tides the depth of water in the two docks is twenty-four feet; they are formed parallel to each other; their common length is about 890 yards. The largest, which has a superficies of above thirty acres, is destined to those vessels returning from the West Indies, which deposit their cargoes in the warehouses of this artificial port. The second, the superficies of which is about twenty-five acres, receives the vessels laid up in ordinary, or taking their outward-bound cargoes. These docks, with their basins, and the locks which connect them with the river, present an area of sixty-eight acres of ground, excavated by human hands, for the reception and moorage of vessels; the total superficies, including that of the quays and warehouses, is 140 acres.

During the busy season this establishment employs as many as 2600 workmen, *&c.* It can admit, at the same time, 204 vessels in the import, and 195 in the export dock, forming a total of 120,000 tons. During the first fifteen years, 7,260 vessels entered them. In fine, upon the quays, under the sheds, and in the warehouses, there have been seen deposited at the same time 148,563 barrels or casks of sugar; 70,875 barrels and 433,648 bags of coffee; 35,158

pipes of rum and Madeira wine; 14,021 logs of mahogany; 21,350 tons of logwood, *&c.*

Nothing appears more simple than the idea of forming separate docks for the loading and unloading of importations and exportations; yet, infinite as the advantages which it affords are, in preventing confusion and the frauds which it naturally produces, the English constructed docks for more than a century before this idea struck them.

At the upper and lower entrances of the two docks a basin* presents three locks of communication: the first communicates with the Thames—the water is kept in it by means of double gates; the second and third locks lead respectively into the export and import docks—they have also double gates. By this means the vessels are able to come in and go out independently of the state of the tide; they may remain in the basin as long as is judged convenient. The water of the docks being but very little higher than that of the basins, it does not press violently on the gates of the locks. It should also be observed that this water having had time to settle in its previous passage through the basin, when introduced into the docks hardly deposits any sediment.

The docks lie in the direction of west to east, inclining a little towards the south. The principal entrance, that of the Import Dock, is in the midst of the smaller side to the west, which faces Lon-

* The upper basin, at Limehouse, is about two acres in superficies; the lower one, at Blackwall, is about six acres.

don; in coming from the city, we reach it by a branch of the Commercial Road.

William Jessop, whose name has already been mentioned among the engineers to whom the construction of the canals of England has been intrusted, furnished the plans of the West India Docks, and directed their execution—a monument which will perpetuate his memory. The mode of construction which we have described, in speaking of the London-Dock, as to quays with concave linings, lock-gates forming a sweep, and iron-bridges, was first put in practice in the establishment now under consideration. After the death of William Jessop, the direction of these works was intrusted to J. Rennie.

The object most essential to explain, with regard to the West India Docks, is the system on which the warehouses and sheds have been constructed, as well as different operations carried on in each. In order to proceed methodically, we will first describe the Import-Dock. Visitors enter them through a gate, where they are required by the porters to produce a ticket of admission, signed by one of the directors. Upon a pedestal facing us, is the statue of a merchant of London, who contributed greatly to the establishment of the docks, as well as to their subsequent prosperity.

The statue is in cast-iron; on one of the pedestals is the following inscription, engraved upon a plate of brass:—

"To perpetuate on this spot, the memory of Robert Milligan, a merchant in London, to whose genius, perseverance, and paternal care, the surrounding great work principally owes its design, accomplishment, and regulations, the directors and proprietors, deprived by his death, on the 21st May, 1809, of the continuance of his invaluable services, by their unanimous vote caused this statue to be erected."

We find ourselves at one end of a wide alley or road, eight hundred and eighty yards in length, formed by a range of sheds on the right, running in a parallel line with the northern quay of the Import-Dock, and on the left, by a line of warehouses, all of one height, and composed of six stories, including the ground-floor; although the fronts of these buildings are not flush, and present a number of breaks not sufficiently motived, the whole arrangement is both simple and convenient*. In the front of each of these buildings, is a perpendicular line of door-ways, through which the casks of sugar are let down. An iron crane is used for this purpose.

The sheds, which run in a parallel line with the warehouses, are of wood, but supported by columns of cast-iron, about ten feet ten inches in height. The

* In order to prevent robbery, the windows have, outside, an iron-grating, the bars of which have small points directed towards each square formed by them. These points, in economizing a great quantity of metal, afford as secure a defence, as if, being continued, they formed a double number of bars: the whole is covered with lattice-work.

capital of these columns is also of iron. The construction of the roof is simple, but firm and admirably executed; all the timbers are both neatly wrought and painted.

The sheds are paved with large slabs of granite, except in the space opposite the cranes on the edge of the water, where, instead of these slabs, the pavement is composed of plates of cast-iron. Though they are four feet square, I did not find a single one broken; while, on the contrary, many of the granite slabs were. This fact may serve to show what the power of iron is, when used as a pavement over which loaded wagons are to pass.

The trucks employed to carry the casks containing the colonial produce, are of a simple structure, and very easily managed. Upon one of these trucks, two men can draw from 1800 to 2200 pounds. The casks are taken from the cranes used in unlading the vessels, to the foot of the large warehouses; and placed immediately under cranes similar in construction to those employed on the quays, but smaller. The casks are then heaved up to the floor story, allotted for the particular kind of commodity which they contain. If any of these casks are found to be damaged, they are repaired under the shed, previous to their being deposited in the warehouses. As this repair takes place upon an iron pavement, there is no loss, even of the smallest quantity, of the valuable commodities which they contain, such as coffee, sugar, *&c.* All these operations are

executed with a degree of regularity, activity, and skill, altogether admirable and striking; and upon these particulars I particularly dwell, because we are far behind the English in this kind of manual labour, so essential both to the economy and despatch of commercial operations.

The system concerning the warehouses, sheds, and machines, which we have just described, is the same through the whole extent of the quays situated north and east of the Import-Dock. We will now pass on to the southern quay.

The shed nearest to the dock is the most remarkable of all for its structure. The pillars which support it, as well as the frame-work of the roof, are entirely of iron; the latter is covered with large slabs of slate: this is one of the most elegant fabrics due to the talents of the celebrated J. Rennie. Its middle corresponds with the middle of the Import-Dock; it is four hundred and forty-three yards in length.

To form an idea of the difficulty of constructing so vast a shed with solidity, it is sufficient to remember how much cold and heat affect iron, and are apt to distend or contract it, even when this metal is least exposed to the usual variations of temperature. This inconvenience, however, has been guarded against in a most ingenious manner. The iron beams, which run from one column to the other, and which are supported by small arches, do not join closely; but a small interval is left between

their extreme points, which otherwise would be in contact. At the same time, the other parts of the structure are so perfectly joined, that they prevent the latitudinal action which might result from the longitudinal play thus allowed to these beams.

At the back of this shed, and in the centre, is an old warehouse, which contains wine on the ground-floor and first-floor, and cotton on the second. Right and left of this warehouse, and upon an equal width, have been constructed two wooden sheds supported by iron columns, and iron circular supports; skylights have been opened in the roof to throw in the light from above. The columns are hollow, and receive the water which runs from the roof. The frame is of wood; but cast-iron has been employed, 1st, to case the timbers in the places where they are joined and are fastened together; 2ndly, to prevent their contact in those points where they might suffer from the pressure, or get heated and rot, on account of the vegetable fermentation, and the dampness of the atmosphere. Finally, bolts of wrought-iron, with screws, keep together those parts of the frame which might tend to separate from each other. This combination of wood and iron would be particularly advantageous in the construction of the naval establishments of the ports of France, where wood is cheaper, and iron more expensive than in England.

Under the sheds, constructed of wood and iron, are spacious and very fine cellars, in which the rum

and spirits brought from the islands are deposited. The pillars of these cellars are octagonal, and are of stone; but the whole arch is of brick, and extremely flat. In the midst of each range of vaults, and in the direction of each row of casks, are iron-ways, upon which the heaviest casks are rolled with the greatest ease. It was of great importance that, in a place where rum and spirituous liquors of a very inflammable nature are kept, the men employed in the service should be able to do their work without lamps or lanterns; this object has been attained by means worthy our notice.

In the first place, the cellars are lighted by vertical lights taken from the interior of the sheds above them. At the key, where two arches cross each other, a well of cylindrical form has been made in the masonry, by which the light descends into the cellar, as by the lantern of a dome. On a level with the floor of these sheds, plates of cast-iron cover these wells or apertures, in which are fixed five lens, a central one, and the four others round it. These lens are of the same description as those called illuminators, which are used by the English in the decks and ports of their vessels to light the officers' births, and the dark parts of the lower decks. We have adopted this mode of lighting in our ships of war; but it would be found particularly convenient in the subterranean parts of our public buildings.

Independently of the vertical lights obtained in the manner just described, a horizontal light, procured by means of reflectors, has been most ingeniously used; the idea of this contrivance is due to a mere journeyman cooper. On one side the cellars receive an oblique light, through a range of windows opening upon a ditch surrounded by iron rails, in the same manner as has been described in speaking of the subterranean parts of the London Docks;

but on the opposite side windows of equal width, though not so high, open under the iron shed, into apertures of a semi-conical form. Just above them, in a perpendicular direction, part of the roof of the shed is glazed. The light descending hence is reflected by a metallic mirror, inclined and forming an angle of 45°, placed inside the cone. This reflector is formed of sheets of tin, nailed upon a long board; the greatest attention is paid to its being kept bright.

Near each window, on the opposite side, is another reflector, equally of tin, placed on an upright and portable stand, so that it can be turned upon its axis, in order to throw the light wherever it may be wanted. The workmen have smaller hand reflectors fixed upon a handle, which they carry about, and use to direct the light into the darker parts of the cellar, which is done by holding them so as to reflect the rays of light which fall from above upon the large mirror. The light thus obtained is sufficiently strong to enable them to see the most minute work.

The lowering and conveying of the casks within the cellars are managed with an ingenuity and economy not less remarkable.

Under the wooden and iron sheds, already described, instead of the wells, closed by a plate of iron, with illuminators to throw light into the cellars, are seen, at intervals, open walls, of an elliptical form, and of a sufficient size, for a cask placed horizontally to descend without difficulty. An iron crane brings the cask perpendicular to the opening, lowers it, deposits it below, or draws it up. The machinery used in drawing up or lowering the casks is separate from the crane itself.

The details upon which I have entered* may

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* M. Dupin has, indeed, entered most learnedly into minute details concerning the machines employed in England, particularly in the

perhaps appear too minute; but we must not deceive ourselves: it is by the care that is taken in improving the simplest operation, that the English have succeeded in producing the greatest results in the shortest space of time, and by modes the most economical. It is this spirit of improvement in things of a secondary nature, that I should wish, first of all, to see introduced into our arsenals, and all our establishments of private industry, in the end, that we might afterwards carry our endeavours to things of a higher order.

Iron rail-ways had been established on the quays of the West India Docks, in the same manner as in the London Docks; but upon its having been found that they impeded the traffic, they have been replaced by roads formed of large slabs, smooth and closely joined, upon which the friction of the wheels is very inconsiderable. In the middle of the pavement are two rows of these slabs, which run parallel with the quays and warehouses; opposite each crane, situated on the edge of the quay, a double row of the same slabs leads directly to the door of the

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London, the West India, and the East India Docks; these details, delivered with all the clearness of an excellent mathematician, are especially addressed to the French, and intended to shew how advantageous it would be for them to imitate the objects they describe. We have, therefore, abstained from translating them entirely, thinking they would not have the same degree of utility with us.—(*Note of Translator.*)

warehouse, or to the sloping passage by which goods are introduced into the vaults below. These cranes, extremely powerful, are of cast iron; the chain which is used to raise the goods, after passing over the wheel at the jib end of the crane, descends, supported by rollers and rolled upon the first horizontal barrel. This barrel has a cogged wheel, which acts upon a pinion borne upon an equally horizontal axis, which itself carries a cogged wheel acting upon the pinion of a third axis, which is immediately turned by the handle. A plain wheel, fixed upon the latter axis, is furnished with a curb called the break, which is made to act by a small iron lever.

The most interesting part of these cranes is the ingenious manner with which their power may be increased or diminished, according as weights, more or less considerable, are to be raised. By this contrivance the same men may work them, whatever may be the object they have to raise, without calling new hands to assist, a thing doubly advantageous, with regard to economy of time and to safety; as the employing additional hands, in case of urgency, was almost always attended with accidents, on account of their inexperience.

East of the establishment we have described, Mr. Rennie has lately constructed a new shed, under cover of which the mahogany brought from the West Indies is deposited. This building is not only remarkable for its structure, but particularly for the ingenious machine in use there, for piling

up and taking down the enormous logs brought under this shed. This system has the advantage of producing considerable effects with a small number of hands: it furnishes the means of piling up and moving the greatest possible number of logs in a given space of time. The savings which resulted from the economy in manual labour during the first six months, were sufficient to defray the cost of this machine.

The shed under which these improvements have been carried into effect, is composed of two contiguous bays; the gutter between them, which is common to both, is supported by sixteen cast-iron columns, about twenty-one feet in height. The beams are curved like those of a ship, to resist the powerful efforts resulting from the momentary suspension of the mahogany logs *.

These sixteen columns are in couples, with the exception of two, which correspond with free passages; the series of columns are thus disposed: 2, 2, 1, 2 2 2, 1, 2, 2. Opposite each couple of columns is a pile of wood, under each bay. There are seven piles, or tiers, one with another, and perpendicular to the direction of the columns. Immediately above the centre of each tier of logs, the ceiling of the shed is open, on a width of above three feet. On each side of this opening or run, the cross-timbers support a strong beam (lougrine). Upon each of them an iron rail-way has been fixed, plain on the outside, but cogged on the opposite; thus is

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* Before employing the iron road-ways and machines we are going to describe, these logs were moved by means of tackles which were struck on the head of a mast, the foot of which was fixed in the ground, while the head was held by stays, which were long on one side and shortened on the other, to bring the head perpendicular to the log which was to be raised; this means was slow and required a great number of hands.

formed a road-way running perpendicularly over each tier, and on its whole length. Upon these rail-ways goes a carriage or machine; it has four wheels, plain in the part which runs upon the smooth part of the rail-way, but cogged in relief on the outside, so as to catch in the teeth of the rails. Another cogged wheel acts upon one of those of the carriage, as well as upon the pinion, the tree of which carries a handle, with which one single man sets the machine in motion, even when loaded with the heaviest log. On the other extremity of the machine is an aperture which may have single or double action, according to the effect to be produced. This tree carries a chain which rolls itself upon a large barrel, placed horizontally, and having a groove in a spiral line in which the chain is received. At the other end the chain is divided into two parts, each of them having a sharp hook, in order to seize more firmly the piece of mahogany to be moved. The axle-tree just described has two handles; and is worked by four men only; five hands are therefore sufficient to move the mahogany logs, some of which weigh as much as five tons.

The shed we have just described reaches the wall of enclosure of the Import Dock. This wall, instead of running in a straight line, is composed of plain and circular parts, combined in a very singular manner. This wall is very high for its thickness, and in giving it this circuitous shape, it was no doubt extended to make it stand firmer. It is thus that a simple playing card, bent in the form of an S, or of an M, can easily stand upright, which it cannot do when it is not bent. At intervals the straight parts of the wall of this enclosure have iron gates, so made as to render it impossible to open them on the outside, and through which the casks of rum are taken out. Merchants pay the excise duties for these spirits only at the time of its being taken out, which proves a great advantage to them.

South of the enclosure in question, commences the northern quay of the Export-Dock. By the side of this quay runs a range of sheds which present

nothing remarkable; they are surrounded by rails. These sheds serve for the deposit of such goods as are brought in the dock, for vessels taking their outward-bound cargo.

I saw in these docks a diving-bell, stationed in a boat, which is used to bring from the bottom of the water heavy or bulky articles. This bell resembles that which I have described, and of which I have given a plan in my work on the *Force Navale*.

For cleansing the docks and basins, use is made of a drag, placed in a boat and put in action by steam. The great economy resulting from this machine is such, owing to the wise manner with which the directors have profited of their local advantages, that one ton of mud may be dragged up and conveyed out of the premises of the establishment for 1*s.* 4*d.*, a result almost incredible in a country where labour is necessarily so dear. I was the first to make known in France this happy usage of the power of steam; a company has since been formed in order to apply it to our public works.

East India Docks.

These are exclusively reserved for the vessels employed in the trade of the East Indies. These docks were erected the last of all. In July, 1803,

an Act of Parliament authorized the institution of a company which formed the plans of this enterprise, and carried them into execution*.

It is essential not to confound the East India Company with that of the docks, or with any company of ship-owners.

The functions and enterprises of the former company are of such magnitude as not to allow them to extend them. They manage their commercial affairs on a large scale, without having any thing to do with the construction of ships, or equipping them on their own account, which is done by the owners; or attending to their reception at their arrival in London, which is done by the Dock Company. The East India Company appoint the captain and officers of the vessels employed in their service; superintend the equipment and dismantling of vessels, and pay the Dock Company, as well as

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* The administration of the company is vested in thirteen directors, elected in fourths every year. Every fourth year, four nominations are made instead of three. The directors must possess, at least, twenty shares; four of them must also be directors of the East India Company. The general interests and accounts of the company, are laid before two general meetings, held in January and July. The possessors of five shares and upwards have alone the right to vote. Besides this, it is necessary that they should either be actually directors of the East India Company, or have been during ten years; or that they should possess at least 500*l.* in the funds appropriated to the equipment of vessels that navigate for this company, or be the husbands, agents, or trustees of a proprietor holding such funds.

the company of ship-owners for the freight, and the moorage in the docks.

However, these two secondary institutions are not altogether strangers to the mother-company. A certain number of the directors of the latter must form a part of the principal managers of the two others. By this means, the East India Company are able to maintain a sufficient degree of influence, to introduce into the auxiliary parts of their service that unanimity of views and that spirit of co-operation which concur to the general good, and are the surest means of promoting it.

Though the ships employed in the East India service draw a very considerable depth of water, they occupy comparatively but a small superficies; besides, considering the immense value of their cargoes, their numbers can never be great; and lastly, their voyages taking a very considerable length of time, there can be but few ships at anchorage, compared to those on their passage: consequently, the docks prepared for these vessels do not require to be of such extent as those appropriated to the active, rapid, and multifarious commerce of the colonies and American states. Hence the capital of the East India Docks is but the third of that devoted to the West India Docks*.

* Having already described the structure of the walls of the quays, the gates of the locks, the turning-bridges and cranes, the forms of which are peculiar to the maritime works of England, it

The establishment which we are about to describe, being intended for the reception of vessels laden with the most valuable produce, it is subjected to measures of a police, whose regulations are much stricter than those of the other docks. Business does not commence till rather late in the morning, and at three o'clock in the afternoon in winter, and, at the latest, four in summer, the ringing of a bell announces that the gates are about to be closed. All work ceases, and, all at once, the men, clerks, and visitors*, as well as horses, carts, *&c.*, quit the establishment. In fine, for the same reasons, the docks are surrounded by very high walls.

The merchandise imported is not deposited within the enclosure of the docks, but is carried away without delay, by means of a great number of carriages mounted on four wheels, of small and almost equal dimensions. These carriages carry a long, large, and deep chest; they resemble, both in

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were a useless repetition to enter into the same details in speaking of the East India Docks. It will be sufficient to state, that the Import-Dock has a superficies of nineteen acres, the Export-Dock ten, and the basin three, (the two docks are connected with this basin by two short locks,) total surface, thirty-two. Hence we see, that this surface is not half of the East India Docks and basins. The depth of these docks, measured from the level of the quays, is twenty-seven feet.

* These are allowed to enter only with tickets of admission, and during the work-hours.

size and appearance, those caravans used by wandering people, and which contain their whole family. They are closed on every side by planks closely joined, and have but one opening, which is behind; this door has a lock, and is secured by bars of iron and two strong padlocks.

Each wagon, which is drawn by two, three, or four horses, is brought to the edge of the Import Quay; it is opened immediately to receive the goods unshipped from the vessel; the casks, bales, *&c.*, are stowed in it, as in the hold of a vessel. The door is then locked, and the wagon takes its direction homewards through that beautiful Commercial Road, which was purposely constructed as a thoroughfare from the docks to the city.

The Export-Dock is the first we come to, on passing through the principal entrance. It is separated from the Import-Dock by a high wall, in which are doors of communication. Vessels come from the Thames by a lock opening in the west of the basin. I noticed over this lock, an iron-bridge for foot passengers, which is of a very light and handsome form, and four feet in breadth.

The East-India Docks, having to receive vessels of the greatest burthen, are deeper than any of the rest; they have never less than twenty-three feet of water.

To the west of the Import-Dock*, without the

* On the western side of the Import-Dock, stands a great ma-

wall of enclosure, we see a group of buildings of a handsome appearance, and which appear quite new. They belong to the Company, and serve as warehouses.

Outside of the docks, along the bank of the Thames, is a park of anchors, cannon, and projectiles, for the vessels employed by the company. It is terminated by a quay, near which ships of considerable burden can come at high water.

DOCKS AND BUILDING-YARDS OF THE PORT OF LONDON.

If, on quitting the West-India Docks, we follow the left bank of the Thames, we find a great number of yards, principally used for repairing and re-fitting the vast number of vessels, that crowd at all seasons into the port of London.

Some of these yards have docks, sufficiently deep and spacious to float vessels ready equipped for sea, stores of masts, *&c.*; all have dry-docks, slips and stocks, for building, repairing, careening, *&c.*

Brunswick-Dock.

This yard is the most considerable of all those employed for the purposes of commerce. It was

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chine for masting, worked from the interior of Mr. Perry's dock, of which we shall shortly speak.

erected by Mr. Perry. The vessels destined for the service of the East-India Company, and which for that reason are called East-India-Men*, are principally built there; for in the language of a nation essentially sea-faring, the name of *man* is given, as an honorary title, to the most important vessels, both of the government and commercial navy.

The arsenal of which we speak, (for it truly merits that name, both from the tonnage and rank of the vessels constructed) there, contains four large slips, a very spacious floating-dock, forges, saw-yard, in a word, all the establishments necessarily attached to a naval building-yard. The shops of the different trades are built of wood or brick, in the plainest way, and without any taste; are kept up with but little care; they would seem rather to indicate the decline of an establishment, than its increasing riches and prosperity. I have visited many other dock-yards upon the banks of the Thames, and have generally found their work-shops very mean. They have nothing remarkable but their dry-docks † and stocks.

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* The vessels which are being built, are placed upon inclined slips. I was present in this Dock-yard at the launch of a vessel destined for the East India Company's service. The directors of the company had all the honours of the fête.

† They are composed of two long straight sides, rather approaching each other at the entrance, and meeting in a half circle at the other extremity.

Many of these docks are built of brick; the more modern are of

At present we see, on the banks of the Thames, but very few of those old dry-docks which were formed of the hull of a vessel, half buried in the ground. We also but rarely meet with those gates in three connected pieces, which are put down when a ship enters the dock, and are taken away when she quits the stocks. We have described them in treating of the FORCE NAVALE, Vol. II. *Arsenal at Chatham.*

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this kind; still the greater part, from motives of economy, are constructed of the timbers of old broken-up vessels. But brick-work is so little expensive, as the bricks are made upon the spot itself, with the clay that is drawn, by the ballast steam-machines, from the bed of the Thames, that the proprietors of such establishments prefer this species of material, the most durable, and the least subject to unforeseen accidents.

Some of these docks have a number of steps; others have but very few, but those large and more elevated; others have none at all. In the latter, ladders are employed to descend to the lower parts. These docks have generally small flights of steps, which rest against the circular part that terminates the extremity opposite the entrance. In general the bottom is above the level of low water-mark. After the vessel has been introduced at high tide, the waters are suffered to retire, the vessel is left dry, and the gates are shut. These gates necessarily open against the water; their form is almost always the same as that of the gates that close the floating-docks; they sweep out in the form of a vertical cylinder, on the side which resists the pressure of the water.

BOOK II.

EASTERN COAST OF ENGLAND.

CHAPTER I.

Left Bank of the Thames.

THE *Bassin* of the Thames* is one of the most extensive and rich of Great Britain; it is also extremely populous, as may be seen from the following table, in which are included all the counties within its limits:—

Counties.	Population Census of 1821.	Square miles.	Inhabitants by sq. miles.
Kent	300,000	921	326
Surrey	406,700	757	537
Berks	134,700	756	178

* The French understand, by the word *Bassin*, all the territory through which the river flows, from its source to its mouth. The bassin extends on both sides of the river as far as the declivity of the soil towards its bed, from the neighbouring springs and rivers, to bring their waters into its stream. Thus, for instance, the county of Lincoln forms a part of the bassin of the Wash, as well as of that of the Humber; that is to say, two-thirds of its territory incline towards the Wash, and pour their water into it; whilst the other third, having a different inclination, looks to the Humber, and contributes to its increase. Having thus explained the meaning of the word bassin, so frequently used by M. Dupin, we may perhaps be allowed to Anglicise it for the sake of clearness.—*(Note of the Translator.)*

Counties	Population Census of 1821.	Square miles	Inhabitants by sq. mile.
Oxford	139,800	751	186
Buckingham	136,800	740	185
Hertford	132,400	528	251
Middlesex	1,167,500	281	4,154
Essex	295,300	1,532	192
Suffolk	276,000	1,512	182
Total of the bassin of the Thames.	2,989,200	7,780	384
Total of Great Britain. . . .	14,355,800	89,930	159

Consequently the *Bassin* of the Thames occupies more than the eleventh part of the territory of England and Scotland united; and on this eleventh part of its territory is accumulated the fifth of the British population! We think that the points of comparison we are about to draw will not be without interest to our fellow-countrymen, and even to foreigners.

COMPARATIVE POPULATION.

Of the basin (bassin) of the Thames, to the whole extent of Great Britain . . . . . as 1 to 5

Of the basin of the Seine to the whole of France, as 1 to 5

COMPARATIVE SUPERFICIES.

Of the basin of the Thames to the whole of Great Britain . . . . as 1 to 11½

Of the basin of the Seine to the whole of France as 1 to 9

POPULATION BY THE SQUARE MILE.

Basin of the Thames, 384 inhabitants.

Basin of the Seine, 184 inhabitants.

Thus, on an equal superficies, the population of the Bassin of the Thames is double that of those

parts of France which border on the Seine! It must be remarked, that in 1750, before the canals of England had yet been formed, the population on the banks of the Thames was but half what it is at present. We are, therefore, at present, at the point that England was at that period, and if we follow the same course she has since pursued, we shall arrive at the same term. This is the mathematical conclusion to which all our calculations lead; this is the moral conclusion to which all those considerations lead, which are founded upon the true principles of the prosperity of nations.

On an extent of 150 miles, above London bridge, the Thames is navigable for barges; it is navigable for vessels of very considerable tonnage, from this bridge to the sea, an extent of sixty miles, making in the whole 210 miles. The numerous rivers and canals that supply this river with their waters, extend its navigation in various ramifications throughout the interior of England, as we have already explained.—*See the preceding Volume.*

The tides also rise to a considerable height in the port of London; the greatest rise thus: at

The London Docks . .	18 feet.
The West India Docks . .	19 feet.
The East India Docks . .	18 feet 8 inches.

The northern bank of the Thames, from the metropolis to the sea, presents neither rivers, ports, nor towns deserving our notice. All that we see in

front of Gravesend is a fort erected to defend this passage of the river, which immediately below this position widens so considerably, that no battery erected upon its banks could extend the range of its fire to the opposite shore,

A little before reaching the cape that advances farthest to the south, we see the hamlet of Southend, or limit of the south. This place, and many others on both the banks of the Thames, are much frequented during the bathing season. Below Southend the coast begins to turn to the north, and afterwards to the west, as far as the gulf of the Wash, which is in a southern direction. This sweep of coast, which forms an immense oval, binds the counties of Essex, Suffolk, and Norfolk.

Following the coast, after quitting the mouth of the Thames, we come to the mouths of the little river Crouch, the alluvions of which have formed several *deltas*. Foulness is the principal, and that which advances farthest into the sea. This river is navigable only to a distance of little more than eleven miles.

About ten miles north of the mouth of the Crouch is the cape, at which terminates, on the south, the beautiful bay of the Blackwater, which receives the waters of the Chelmar and of a great number of little rivers. The works undertaken to render the Blackwater and the Chelmer navigable, belong to a company instituted by the 6th and 33d acts of Geo. III. At the place where colliers can land, on

coming from the sea, and which, on that account, is called *Collier's Reach,* a dock has been constructed, which serves for the reception of ships. The Chelmer is rendered navigable as far as Chelmsford, a town containing 4000 inhabitants, and which is the principal city of Essex. During the late war, two very considerable ranges of barracks had been built on its territory, for the cantonment of upwards of 4,000 soldiers, who were to protect the left bank of the Thames against the landing of the French.

The northern coast of the bay of Blackwater also receives the waters of the river Colne; ships go up to Wivenhoe, where there is a large dock-yard. Small vessels can proceed as far as Colchester, a town, which within its territory, and that of its liberties, contained a population of 14,016 inhabitants, according to the census of 1821. It was, as its name indicates, a Roman town, and is situated upon an eminence, a position well adapted for defence, according to the system of warfare pursued by the ancients. The ancient fortifications were demolished during the civil wars, under Charles I., but the castle still subsists; it was built by the Normans with Roman bricks, which doubtless came from the ancient ramparts. The river navigation and oyster fisheries add much to the riches of Colchester.

At the distance of about fifteen miles from the bay of Blackwater, begins another bay still more important, which receives the waters of the Stour and Orwell, two rivers that present a bed of

considerable breadth near their mouth. The Stour is navigable, on a distance of twenty-eight miles, as far as Sudbury, a town, the name of which will ever live in the annals of British industry. It is there that Edward III. settled the Flemish, who, in the fourteenth century, came to teach the English the method of working wool upon frames. The progress made in this art soon rendered Sudbury rich and populous*. It is true, that later other towns have surpassed it; still, it has not ceased to be remarkable for its manufactures of woollen stuffs, particularly for its crapes for mourning, and buntine for flags. Neyland and Manningtree, two small market towns, whose manufactures of woollen stuffs also form their principal riches, are situated, like Sudbury, on the banks of the Stour.

Harwich, built upon a peninsula at the mouth of this river, is rich and commercial. It possesses a dock-yard and arsenal, belonging to government; but since the improvements made in its larger establishments of this kind, the government makes no farther use of it, except for refitting ships, in time of war. The principal resources of the town consist in its hot and cold sea-water baths, and artificial mineral water, its fishery, and the building of merchant-vessels. Its bay, formed of the mouths of the Stour and the Orwell, is safe and commodious. In fine, its port is the point of arrival and departure

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* In 1821 this town still reckoned 3,950 inhabitants.

for the packet-boats to and from Holland and Belgium. It was during the period of the great struggle between the English and the Dutch, that the bay of Harwich assumed an important aspect. More than once, during this furious contest, not less than a hundred men of war and three hundred merchantmen have been moored at the same time in this bay.

In front of Harwich is the fort of Landguard, which commands the entrance of the bay, and near which is the only navigable channel for vessels of great burden: at high water it is surrounded on all sides by the sea.

The Orwell, which falls into the sea opposite this port, is navigable for large vessels as far up as Ipswich, a town containing 17,186 inhabitants. The port of Ipswich was almost filled up by the alluvions of the river; but, by an Act of Parliament obtained some few years since, such measures have been taken as are likely to render it of safe and easy access. Ipswich possesses a college, four charity-schools, and a library, formed by public subscription. During the late war, barracks were built near this town for ten thousand soldiers.

A company, authorized by Acts 33 and 45 Geo. III., has rendered the Orwell navigable from Ipswich to Stowmarket, where there is a considerable rope-manufactory for merchant-vessels.

North of the bay of Harwich, the Deben empties itself into the sea at Felix-Stow; it is navigable to

the distance of ten miles, as far as Woodbridge, a town containing 4,000 inhabitants, and which has many dock-yards.

On returning to the coast, and continuing our route, we come to the two small rivers, the Alde and the Blyth, which are navigable a few miles only from their mouth.

Orford, near the mouth of the Alde, was formerly a flourishing port, but has been destroyed by sands and alluvions. Aldborough, also situated upon the Alde, is a Roman town, where many antiquities have been found; like Orford, it has entirely fallen from its former splendour.

Southwold, built at the mouth of the Blyth, carries on a considerable commerce, the principal objects of which are fishing and sea-salt; its population is 1,676 souls. A canal parallel to the Blyth, and nine miles long, runs from Southwold to Halesworth, which latter town contains 2,166 inhabitants.

In proceeding towards the north, we cannot but remark the picturesque situation of Lowestoff, a town built upon the promontory, the most eastward of all the British coast, and known to seamen by the light-house that has been erected upon it*. The beauty of its situation renders it a favourite

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* During the winter, the coast we are now visiting is very dangerous; it is lighted by a great number of light-houses, established at the most essential places.

bathing-place during the summer months. It is the cod-fishery in the north, and that of herrings in the more neighbouring seas, that form the principal riches of this town. It returned 3,675 inhabitants in 1821. During the war of 1778, two forts were built, one to the south, and the other to the north of Lowestoff.

We now come to Yarmouth, a port admirably situated for connecting the maritime navigation of the north of Europe, with the inland navigation of the county of Suffolk. The Waveney and the Thuron empty themselves into the Yare, the mouth of which gives its name to the port and town of Yarmouth.

The Waveney, which runs towards the north-west, separates the counties of Suffolk and Norfolk; it passes by Beccles, a town of 3,493 inhabitants; it is navigable to the distance of twenty-five miles, as far as Bungay, another town nearly equally populous. Beccles and Bungay are the market-towns to which the farmers of the country round bring their produce destined for the Yarmouth trade.

The Yare is navigable to the distance of twenty-two miles, as far as the capital of Norfolk, Norwich, the population of which amounts to 50,288 souls; this is the most important town of all the peninsula comprised between the Thames and the Wash. It is flourishing, both on account of its commerce and manufactures. It manufactures camlets and bombazine, which are exported to the East Indies. It

consumes principally the wool produced in the counties of Lincoln and Leicester. For some time past, it has also commenced the manufacturing of canvass, cotton, and silk. We cannot omit noticing the intercourse and mutual dependence existing between Norwich and Yarmouth, on account of their commercial transactions. The latter town is the outlet through which the goods manufactured in the former find their way to foreign markets; while the former is the principal cause of the active shipping of the latter. We have already noticed, that a similar dependence subsists between Hull and Leeds, Manchester and Liverpool. From Yarmouth, the productions of Norwich and of Norfolk are directly conveyed to Russia, Sweden, Denmark, and Holland, and by the extensive commerce of England, to all the other parts of the globe.

This shipping, added to the advantages derived from the herring and mackerel fisheries, has raised the population of Yarmouth to 18,040 inhabitants. This town finds an additional source of wealth in the great numbers of visiters who resort hither during the bathing season*, either for the purposes of health or amusement. The port established in

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* In one of the sea-bathing establishments, the sea-water is raised and brought into the baths by means of machinery. Near this building is the pier of the harbour, which is upwards of one hundred and fifty yards long, and twenty-six wide at the summit.

the bed of the Yare, is remarkable for the beauty of its quay, the width of which is, in some parts, as much as 154 yards. Yarmouth is embellished by a column 140 feet high, erected in honour of Nelson, whom the county of Norfolk ranks among the most renowned of her sons.

We have observed, that the river Thurn falls into the Yare opposite Yarmouth. There are two rivers of this name which join, and cross almost at right angles; that which does not run down to Yarmouth, falls into the sea, in the north of this town. From this place to Lynn, situated at the extremity of the Wash, there is no other navigable river. Nothing else presents itself than Clay Haven, which is an open road, near which are many adjoining villages which bear the name of Burnham. It was in one of these villages that Admiral Horatio Nelson was born.

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CHAPTER II.

The Bassin of the Wash.

The gulf of the Wash receives the waters of a great number of rivers, which intersect a very flat and marshy country, called for this reason the *Fen District*. The *Bassin* of the Wash comprehends the following territory:

Counties.	Population.	Square Miles.	Inhabit. by sq. miles.
Norfolk	351,300	2,092	167
Cambridge	124,400	858	145
Bedford	85,400	463	184
Huntington . . .	49,800	370	124
Northampton . .	165,800	1,018	163
Rutland	18,900	148	127
Lincoln, ($\frac{2}{3}$) . .	192,533	1,831	105
Total	988,133		

By this table, it will be seen that the bassin of the Wash is, proportionally, much less populous than that of the Thames. But nature threw immense difficulties in the cultivating and rendering habitable a country, the greater part of which is covered by stagnant and unsalubrious waters. As far back as the middle age, it was found necessary to call in the aid of all the resources of the industry

of Holland, in order to save this country from inundations, and to recover those plains, then alternately overflowed by the sea and by rivers. In carrying these works into execution, advantage has been taken of this great mass of waters, in forming canals for the inland navigation, which have powerfully contributed to the prosperity of the country.

In order to describe with regularity the marshy country of which the gulf of the Wash is, as its very name indicates, the pool or drain, we will consider this gulf as the centre of our course, which we will in turn direct east and south, west and north.

*Lynn-Regis** presents the first port of any conse-

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* It is so named, to distinguish it from several villages of the name of Lynn, which are all situated in Norfolk.

Before quitting Norfolk, let us observe the system of high-roads which traverse this country as well as Suffolk. Three roads of the first order, from London, cross these two counties; the eastern one leads to the sea-towns, through Chelmsford, Colchester, Ipswich, Yarmouth, and Norwich. From Ipswich, a road branching off towards the interior, leads to Harwich. The central road passes Newmarket, a town celebrated for its horse-races; it reaches the sea, north of the town of Great Walsingham. Lastly, the northern road passes through Cambridge, Ely and Lynn, and follows the eastern coast of the Wash, as far as Burnham.

Cross-roads unite Norwich, Newmarket, and Cambridge, Ipswich, Bury Saint Edmunds and Ely; and lastly, Lynn and Norwich, through Thetford, Brandon, and Mildenhall.

It is remarkable, that the interior of the counties of Essex, Suffolk, and Norfolk, should have no navigation canal. That from London to Cambridge, is the only one that touches these counties; with the navigation of the river Lea, it forms, from Lynn to London, the eastern limit of the artificial navigation of England.

quence in the south-east of the Wash. This town, which reckons 12,253 inhabitants, is built at the confluence of the Lynn and the Great-Ouse; it carries abroad an extensive and considerable trade, employs a great number of small vessels on the coast, and does a great deal of business with the inland counties, by means of the rivers of which it is the outlet. A fort, and some other places of defence, protect this town on the north, as well as its port established near the mouth and in the bed of the Great-Ouse.

If from the port of Lynn we ascend the eastern bank of the Great-Ouse, we find, 1st, the Lynn, navigable to Narborough, a small market-town; 2ndly, the Stoke, navigable as far as Stoke Ferry; 3dly, the Little-Ouse, navigable through Brandon, a very mercantile town, as far as Thetford, at the confluence of the Little-Ouse and the Thet. During the Heptarchy, Thetford was the capital of the country possessed by the English of the east or East Angles. Under Edward III., it was still an episcopal town*, which counted twenty churches and eight monasteries. At present it ranks only as a market-town, containing about 2,500 persons. It carries on a great trade in corn, which is exported from Norfolk; breweries and founderies add to this

* Since the decline of Thetford, the episcopal see has been removed to Norwich, which is now made the capital of Norfolk.

source of riches. 4th, the Lark, navigable by Mildenhall, as far as Bury Saint Edmunds, so named, because it is the burial-place of Saint Edmund, who was massacred by the Danes, in 870. The population of this town has risen to 10,000 souls. Mention is made of its halls for the sale of wool, its market-place, its meat-market, *&c.;* 5thly, the Cam, navigable as far as Cambridge. There we reach the line of inland navigation, explained in the chapter on *the hydraulic Communications of London. (See the preceding Vol.);* 6thly, the Ivel, navigable as far as Biggleswade, a mercantile town, which reckons 2,500 inhabitants; 7thly, Bedford, the capital of the small county of the same name, containing 5,466 inhabitants. It is surprising that the Great-Ouse has not been rendered navigable beyond Bedford, as far as the Grand Junction Canal, which this river crosses. Were this effected, the trade carried on by the towns situated on the Wash, would be united to the general system of the inland navigation.

We will now descend the Great-Ouse, following its left bank. The first place worthy of notice is Huntingdon, the capital of the county of the same name. This town, which, in the middle age, could reckon as many as fifteen churches, is now reduced to four parishes, and has not more than 2,800 inhabitants. Below Huntingdon is Saint Ives, a town of 2,777 souls. Some distance hence, a communication-canal branches off, and extends as far as

Wisbeach. It joins the lower part of the main stream of the Great-Ouse, by three other branches, running in a parallel direction, at a short distance from each other, and which are distinguished by the names of the old and new river of Bedford.

A little below the confluence of the Cam with the Great-Ouse, is the episcopal town of Ely, whose cathedral is generally admired. This edifice, which was founded by the Normans, at the conquest, was not completed till three centuries after. In 1821 the population of Ely had increased to the number of 5,079. The situation of this town is very unfavourable*, on account of the immense marshes by which it is surrounded. However, since the year 1754, owing to the patriotic zeal of Bishop Mawson, the works for draining, and the fine embankment of the Ouse, have tended to render the country more salubrious, and enabled vast tracts of land to become cultivated.

Below Ely, the Lark crosses the Great-Ouse, and afterwards the Wisbeach, and falls into the Nen. To avoid the navigation of the lower part of the Lark, a canal was constructed in 1794, joining the Wisbeach to the town of that name, which exports great quantities of corn from the neighbouring country, and imports coals and manufactured articles. Wisbeach has 7,877 inhabitants.

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* The territory round this town, from its appearing to rise out of the waters, is called the Isle of Ely.

The Nen and the Wisbeach fall into the sea at the same place, at the extremity of a spacious bay called *Cross-keys Wash.* In navigating the Nen we may go, in passing through Peterborough, an episcopal town of 4,598 souls, as far as Northampton, the canal of which leads to that of the Grand Junction. (*See* vol. I., book 4, chap. 4.) Northampton, the capital of the county of the same name, contains 10,793 inhabitants; it is celebrated for its markets for horses, which are considered superior to all others in Great Britain; its very position, close to a country gained from the waters which formerly covered it, and abounding in rich meadows, gives its commerce an equal superiority. At Northampton, industry must naturally have taken a direction towards such objects as are furnished by the horses and horned cattle, in which its neighbourhood abounds. Considerable quantities of harness, boots, and shoes, are manufactured here for exportation.

Below Peterborough, a short canal leads from the Nen to the Welland, at the place where the little town of Crowland, which contains 2,113 souls, is erected. We may go up the Welland, in passing by Market Deeping, another little town, the very name of which indicates its low situation; here the bed of the river is much higher than the contiguous country, the draining of which is effected by means of machines borrowed from Holland. The Welland

is navigable as far as Stamford, which reckons 5,050 inhabitants; near this place stands the magnificent mausoleum erected to Burleigh, minister of Queen Elizabeth.

The Welland and the Glen fall into the Wash at the same place, in a bay called *Foss-Dyke Wash.* This bay derives its name from the ancient *Fossa* of the Romans, which was re-made in the middle age, under the Dutch name of *Dyke*, and carried from the Trent to Lincoln, where the old Witham begins to be navigable, which discharges its waters into the Foss-Dyke Wash.

Boston is a sea-port, established on the old Witham. This, next to Lynn-Regis, is the most important port in the whole gulf of the Wash. A canal leads from this port to the confluence of the Glen and the Wisbeach, in order that the boats destined for the inland commerce may not have to go through the bay. The tower of the principal church at Boston is surmounted by an octagonal lantern, the light of which is seen at a great distance; it serves as a guide to those seamen who pass the dangerous shoals, known by the name of *Boston Deeps.* On the 10th of November, 1820, by the simultaneous efforts of a very high spring-tide, and a violent tempest, the sea embankments were broken down, and a reat part of Boston and its environs was inundated. This town has 10,330 inhabitants; and 125 ships, measuring together 7,993 tons: it is the

maritime outlet for the productions of Lincoln and the adjacent country.

It is remarkable that Lincoln, as well as many other towns in the neighbourhood of the eastern coast, which we have just described, had a larger population at the time of the heptarchy and of the Saxon kings than at present. It is more inland that industry has been the means of an increase of population. Lincoln had formerly a great number of monasteries, and fifty-two parishes, which it was found necessary to reduce to fifteen, in the time of Edward IV. However, we should estimate the population of the ancient cities much too high, if we were to judge of it according to the number of parishes which these cities possessed, and according to the average number of the inhabitants of modern parishes. We may add that Lincoln, as well as all the other towns of England, has increased in population by the recent progress of all the useful arts, and the improvement of the state of society. In 1811 it did not possess 9,000 inhabitants: in 1821 it had 10,367.

Between Lincoln and Boston a canal, which was opened in 1792, crosses the Witham at right angles, and passes from Sleaford, a town of 2,000 souls, to Horncastle, a town of 3,000.

Such is the total of the navigable outlets which open in the Wash. Following the sea-coast, to the north of this gulf, we find no other sea-port worthy

of being remarked, till we come to the entrance of the Louth. This river is deserted for a canal, which was opened more than forty years ago, from the sea to the town of Louth, which now reckons upwards of 6000 inhabitants, enriched or supported by manufactory and commercial industry.

CHAPTER III.

The River Humber.

WHAT the English call the river Humber is a very deep gulf, formed by the mouth of the Ouse. The following counties border on the Humber:—

Counties	Population	Square-miles	Inhabitants by the sq. mile.
Lincoln ($\frac{1}{3}$) . .	96,267	915	105
Leicester . . .	178,100	803	222
Nottingham . .	190,700	837	228
Derby	217,600	1,033	210
Stafford . . .	347,900	1,148	303
York	1,197,130	5,961	200
TOTAL . .	2,227,667	10,697	

Hence we see that the extent of country through which the Humber runs is far more important than that of the Wash.

The first port we meet with on the northern bank of the Humber, is that of Great Grimsby, almost entirely choaked up by sand-banks. Within these few years a dry dock has been established here. Great Grimsby* has only 3,000 inhabitants;

* In this town and the coast adjacent, in a space of about fifty miles in length and from nine to twelve in breadth, on digging below the level of the sea, a bed of clay is found, the average thickness of which is from thirty-six to forty feet; when this is

it reckons, at this moment, seventy-two vessels, measuring 3,169 tons.

In advancing some way up the gulf, we find:— First, facing Hull, and on the road to London, Barton, a town of 2,496 souls. At the epoch of the Norman conquest, Barton was a considerable port, but it has lost much of its importance since the foundation and rise of that of Hull. Second, the mouth of the Ancholme, which was rendered navigable in 1802, by means of a parallel canal. A short canal, opened in 1793, already formed a communication between the town of Kaistor and the Ancholme. Thirdly, the mouth of the Trent, one of the finest rivers of Great Britain, and one of the principal links in that vast chain of navigation, which unites all the central parts of England, and of which we have attempted a description in the preceding volume, when treating of the hydraulic communications of which Hull is the centre.

Hull owes its foundation to the enlightened views of Edward I. Having, on his return from the conquest of Scotland, visited the confluence of the

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penetrated, a spring of sweet and pure water gushes forth, in some places to the height of ten feet, but generally to four. Before this phenomenon was discovered, the inhabitants were obliged to make use of a bad marshy water. The expense of boring, and of the leaden pipes necessary for the passage of the water, does not amount to more than two guineas. A packet-boat goes every day to and from Boston to the latter port, in order to carry passengers.

Hull and the Humber, this prince was struck with a position so well adapted to form a place of defence, and, at the same time, a centre of commerce between the north and south of Great Britain, and between the interior of England, and the coasts of Flanders, Holland, Denmark, and Sweden. It was here that he signified his pleasure, that the port of Hull should be formed: he built a fortified town, which he named Kingstown, and which was highly distinguished by his royal favour. The successors of Edward increased the privileges of Hull to a still greater extent; they erected it, with its liberties, into an independent county; they gave it a council of aldermen, headed by a mayor—an organization reserved for cities of the greatest importance.

In proportion with the increase and improvement of the productive industry of the *Bassin* of the Humber, the commerce of Hull has become more active and extensive, more especially since the formation of the canals which connect this town with the great ports on the western coast of England, as well as with the whole of the interior. The Act of Parliament, which gives permission to individuals to undertake certain branches of commerce with the Indies, on their own account, has ranked this port in the number of those which send out and receive vessels destined for this important trade. Hull carries on a considerable trade with the north of Europe, and particularly with the Baltic. The whale-fishery, however, must be reckoned among

the principal sources of its opulence. It was the inland-fishery which laid the foundation of its wealth, augmented afterwards by that of Greenland*.

SHIPS OF EVERY KIND.			GREAT FISHERY CARRIED ON BY HULL.			
Years.	Entered.	Left.	Ships.	Tonnage.	Crews.	Tons of Oil.
1811	339	385	42	13,570	1,716	5,398
1812	306	317	49	16,097	2,046	6,502
1813	445	404	51	17,218	2,112	3,529
1814	757	410	59	19,416	2,442	7,406
1815	748	584	58	19,096	2,418	3,746

Hull is not exclusively devoted to a foreign commerce; manufactures flourish there, among which there are several for the making of soap; there are

* As early as the end of the 16th century, the inhabitants of Hull frequented the coast of Greenland. For a great number of years, they carried on a lucrative fishery there, the prosperity of which, however, towards the middle of the 18th century, suddenly declined in all the ports of England.

A persevering and speculating merchant, of the name of Standidge, was anxious to promote this branch of industry. He, therefore, fitted out a vessel on his own account, which he sent to Greenland, an enterprise which heretofore had been undertaken by none but companies, and for a considerable time past with but little success. On her first voyage, this vessel returned with one whale only, but she brought four hundred seals. At this period, the skin of the seal was not applied to any use, and was therefore thrown into the sea; but it struck Standidge that it might be tanned,

also sugar and train-oil refiners, together with iron-founderies, lead-mills, *&c.* With all these means of prosperity, the population of Hull had risen, at the last census, to 31,425 inhabitants.

The old town has but a small number of streets, wide and straight; but the new part, built outside of the ancient ramparts, is well laid out, handsomely built, and remarkably clean, for a sea-port.

Formerly a rampart extended in the east in front of the river Hull. Three other fronts, which were nearly straight, formed the south-west and north sides of the tolerably regular quadrangle by which the old town was enclosed. All these fortifications have been razed to the ground. The wall facing the Hull has been replaced by a small triangular citadel. A tolerable battery towards the sea, artillery store-houses, barracks, *&c.*, occupy the interior; it is guarded only by a few old soldiers.

The tanners of Hull refused to perform this operation, saying they could not think of soiling their pits with the skins of fish; it was altogether beneath them!

Standidge applied to some other tanners of a neighbouring town, whose ideas with regard to their trade were not quite so high. This idea succeeded, and shortly after, both he and his family wore seal-skin shoes. He thus enriched his country by a new article of trade, and a new species of product. Seal-skins, which before fetched but *3d.* or *4d.* each, now rose to the value of *5s.* or *6s.* This is now become an important branch of revenue, both to individuals and to the public treasury. The Greenland fisheries, thus revived by Standidge, began from that pe[illegible] to be carried on with fresh vigour.

The mouth of the Hull is protected by a pier, which forms an elbow, and commences at one of the projecting angles of the citadel.

The wall which formerly ran along the bay of the Humber, in the south of the town, is now converted into a quay of a very irregular form.

On the sites of the two other fronts of the fortification on the land side, two docks have been formed, which are much longer than they are wide, particularly that which is the most ancient, and which is called the *Old Dock;* it lies to the north of the town; the other, which, for the opposite reason, is called the *New Dock*, lies to the west.

The *Old Dock*.—It is hardly fifty years ago, when the vessels found no other port than the bed of the Hull, beginning at its mouth; and, as this river has generally but little depth of water, these vessels at low tide were left aground upon the mud, which the sea deposits very abundantly.

By an Act of Parliament, in 1774, a company were authorized to form, within the space of three years, a dock and warehouses, on the spot occupied by the northern front of the old fortifications. Its length is about 765 yards, its breadth eighty-seven yards, and its depth twenty three-feet. It is capable of containing 130 ships of 300 tons each. The superficies of the dock, together with the quays and warehouses by which it is surrounded, exceeds thirty acres.

The lock which leads into the old dock, is much

wider than the aperture of the lock-gates, a measure which has been taken in order to prevent the vessels coming in and out running foul of each other*.

The foundation of the walls with which the lock is lined, presented peculiar difficulties. The soil in this place, bordering the bed of the Hull, is a kind of loose sand-bank. The first lining

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* The lining of the quays of this lock is concave, like that of the quays constructed for the London-Docks. The walls are of brick, like those which surround the dock. They are crowned by a single course of stone.

The stones, which form this upper-course, instead of being joined as usual by iron-cranks, are united by key-stones, the figure of which is that of a rectangular prism. These keys are inserted vertically between two contiguous stones, half in each of them, and so that the square of the base of the prism, which is level with them, has one of its diagonals running in a line with the joint of the two contiguous stones.

Besides the course of stones just mentioned, there are two other ranges equally of stone, the one about one-third, and the other about two-thirds of the whole height of the wall. The intermediate range is composed of three courses. The lower one is single, and projects by about four inches. This projection serves as a support to the wooden fence, the object of which is to guard the walls from the vessels running against it. The timbers composing this fence rise as high as the lower joint of the upper range of stone. About one foot and a half below their summit, each of them is fixed to the wall, by means of a strong iron bolt running through it intoa cavity of the wall, where it is bent at right angle, in order to adjust itself into a pin with a round eye, (piton) fixed in a piece oftimber, imbedded horizontally in the masonry. Just above the bolt, a small opening has been made in the wall, so that when it is necessary to take down the fence, it may be done without being obliged to demolish any part of the masonry.

that was built having given way, Mr. Rennie was charged with the task of constructing it anew, and he conceived the idea of a new kind of foundation, at once simple and economical.

One of the long sides of the old dock is bordered, through nearly the whole extent, by a shed of considerable extent, made of wood, and on a very common plan of structure. It is not kept in that order which, to all the English structures of the same kind, gives that air of neat and new appearance which constitutes their greatest beauty.

Behind this shed are the warehouses of the Old Dock Company; they are spacious and regular. Small iron cranes are fixed, at certain distances, to the upper part of the building; they serve to raise or lower the goods, which are either brought in or taken out through the door-ways, in every story, under the cranes, as is practised in the East India Docks. The heavy goods are brought to the warehouses on trucks, which run upon iron ways.

On the sides of the dock, along the edge of the water, there are wooden cranes, of a simple structure, though of considerable power and service. I remarked one forty feet in height, and about twenty in horizontal bearing; it had no curb. The engineer of Hull, who constructed this crane, thinks that, by this means, the fear of danger obliges the workmen to bestow incessant attention to the working of the crane, and to slacken its force by degrees only;

while with the curb, the degree of swiftness acquired by the weight is stopped instantaneously, a thing which cannot be done without giving so violent a shock to the machine, as soon to injure its solidity.

In the old dock also is a ballast machine, one of the first of its kind employed in Great Britain. It is placed on a large barge, and put into motion by horses; the pinions, wheels, supports, and every thing is of wood. This machine is a curious monument of art, when compared with the perfect engines of this kind employed at present, and yet it is not much more than thirty years old; it was built by Mr. Rennie.

New Dock.—One is struck with the vast improvements which maritime establishments have of late undergone, in comparing the imperfect works of the Old Dock with those of the New. The foundation-stone of the latter was laid in April, 1807. This dock occupies nearly the half of the western front of the old fortifications; it has the form of a trapezium 120 yards long and 320 wide; it has a superficies of seven and a half acres, without including the basin*. The quays and warehouses belonging to the New-Dock Company occupy a space of three acres.

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* This basin is formed, 1st, in the part which is inland, by a long side and two small ones, which are perpendicular to it. 2dly, in the part which is on the river, by two piers (*jetties*) having each of them, from their point of departure from the shore, an oblique direction across the river, and then turn in suddenly at right angles,

The waters of the Humber daily deposit a prodigious quantity of mud; that which is deposited in the new basin, by the waters, renewed in part at every tide, forms a bed, which, upon an average, acquires a depth of more than three feet every year. This bed, as may be supposed, is much deeper in the basin. In order to clear it out, they have had recourse to a very ingenious plan. In the ground which separates the dock from this basin an enormous pipe of cast iron is bedded in a direction parallel to the course of the Humber. From this large pipe a number of small ones, part in a perpendicular direction, and which open into the bottom of the basin through the wall that forms the lining. At low tide the water of the New Dock can be let in at pleasure into the large pipe; this produces so many currents of water, at once parallel and equidistant, by which the bed of mud is furrowed and divided in different directions, and leaves but little trouble to the workmen employed in cleansing the bottom of the basin.

When, at the entrance of the New Dock, they had to build the walls of the basin, a long and difficult operation on a loose and yielding soil, Mr. Rennie, to whom the task was intrusted, conceived the bold

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which gives the entrance of the basin the appearance of a funnel. The long side at the bottom, and the two adjacent ones, are built of freestone. The two angular *jetties*, which form the fourth side, are of wood; it was apprehended, in this part, that the soil would not have sufficient strength to bear the weight of a wall.

idea of making a semicircular dam, 110 yards in diameter. The object of this engineer in thus isolating so large a space, was to be able to found, all at once, and without having recourse to pumps, the long wall of lining at the extremity of the basin, and the lock at the entrance of the dock. It was within this dam that the stones necessary for the masonry were cut and prepared.

The lock gates which close the entrance of the New Dock are convex, and admirably executed.

Here, as in those of London, in front of the first gate, a large and deep groove is seen, cut into the masonry, in a vertical plane; it serves to receive the keel, the stem and the stern-post of a gate-boat, used when it is wished to dry the dock, and repair or visit the gates*.

The New Dock, like the Old, is of brick, strengthened by some isolated layers of stone. On the eastern side is a shed entirely new, which has nearly the same length as the dock itself. Its centre is paved with ten ranges of large slabs of stone; two similar ranges lead to each crane erected, upon the eastern bank of the

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* This gate-boat was built in laying its keel, stem, and stern-post on the stocks, upon the very spot where it is to be used, so as to make it fit exactly. The form of this boat is very simple; the bottom has the figure of a demi-elipsoide, bulging a little towards the extremities. The wall is vertical below the deck, to a considerable depth below the water mark. I observed upon its stem and stern, a water-scale, marking a height of thirty feet. The gate-boat is kept in good order, and has a deck. When I visited it in July, it was covered with an awning, above which arose two small ventilators, to renew the air in the hold.

dock. The southern extremity of this side opens upon a street that leads to the quay of the Old Dock, in front of the warehouses. The centre of this street has a double iron rail-way, which serves for the conveyance of goods from one dock to the other: the tracks for the wheels are hollow, and below the level of the pavement, in order not to impede the passage of other vehicles.

In 1814, a project was formed for digging a third dock, in the direction of this street. If this had been carried into effect, the old town would would have been completely surrounded by the waters of the Humber and the Hull, and by the three docks. The inhabitants, alarmed at the sudden decline of trade that followed the peace of 1815, for a time abandoned this project. But in the summer of 1817, at the first dawn of returning prosperity, these plans of aggrandisement were again resumed.

In the New Dock there is a beautiful ballast machine, which is put in action by one of Watt and Boulton's steam engines.

The cranes erected upon the quays of the same dock are all of iron.—(*See plates.*)

We will now follow the coast, taking our departure from Hull. From this place to Cape Spurn, at the entrance of the Humber, we find no port worthy of notice. North of this cape we find the very small town of Hornsea, and afterwards Bridlington, which reckons 4,275 inhabitants, and whose road furnishes very good anchorage. We double Flamborough-head, and arrive at *Scarborough,* a town of 8,188 souls, much resorted to for its mineral waters and

sea-bathing. Fishing is one of the principal resources of its inhabitants. Its port, which has been protected by a commodious quay, offers an important shelter to colliers, and to the steam-boats that run between Edinburgh and London.

Whitby is the last remarkable port on the Yorkshire coast. It is dry at low water, but the spring-tides rise from thirteen feet to twenty; and even the neap-tides rise from ten to thirteen feet. Various acts have been passed during the course of the last century, the object of which was to improve this port, and render it more secure. It is protected by two handsome jetties, which extend from east to west, and leave only an opening necessary for vessels to pass. The parish of Whitby has a population of 12,331 inhabitants. The construction of vessels, fishing, and trade abroad, form the principal riches of this population. There are also some handsome alum manufactories in this neighbourhood.

CHAPTER IV.

Coasts of Durham and Northumberland.

We shall describe, in this chapter, the coasts of the two counties which terminate towards the north, the eastern part of England. The following are the statistic data of these counties:—

Counties.	Population.	Square mile.	Inhabitants by the sq.-mile.
Durham . . .	211,900 . .	1061 . .	199
Northumberland .	203,000 . .	1871 . .	108
Total . .	414,900 . .	2932 . .	141

The river Tees, which serves as a limit to the counties of Durham and York, is not even navigable as far as Darlington; the towns of Stockton and Yarm are built upon its banks below this point. Yarm has 1,504 inhabitants, and has been much enriched by the building of Sunderland bridge; because the road from York to Sunderland and to South Shields passes through Yarm, as well as through Stockton.

Stockton, one of the handsomest trading towns in the north of England, possesses a theatre, schools, literary institutions, public libraries, *&c.* Its bridge over the Tees has five arches, the principal of which has a space seventy-two feet; it was built between 1764 and 1771. This town has various

manufactures, building docks for great vessels intended for the Indian trade, and lastly, a spacious Dry-Dock. It carries on a considerable trade with Norway and the Baltic. Its port is the point of arrival and departure for the packet-boats that regularly run between London and Hull, Newcastle and Sunderland. By means of these different branches of industry, this town which, in 1661, consisted of only 120 houses, now reckons 3,164 inhabitants, according to the last census.

The first place we find north of the Tees, is Hartlepool, a town situated on a small promontory, surrounded on all sides by the sea, except towards the west. Its port, which is in great part choked up, can serve only for the smaller kind of vessels. For some years past, Hartlepool has become a favourite place of resort for sea-bathing.

Sunderland.—On the right bank of the mouth of the Wear stands Sunderland, and on the left Wearmouth. The total population of these towns amounts to 24,000 inhabitants. These two towns are united by a bridge of a single arch, the span of which is 236 feet, and ninety-eight from the keystone down to the level of highest tide*. (*See the plate.*)

* Mr. Wilson, the ingenious architect who built this bridge, and who has the charge of attending to its repairs, resides on the right bank of the river, in a house built at the expense of the company which undertook this speculation. In front is the toll, where every passenger pays a halfpenny, and horses, carts, and carriages in proportion. Permission is obtained to visit the interior of the bridge, by paying a consideration to the guide.

Nothing can be more striking than the view of these two towns and the bridge that unites them; this majestic arch, which is suspended as it were in the air, and which permits ships of very considerable tonnage to pass under its span with topsails set, while enormous wagons, drawn by horses, are seen passing over its aërial terrace; an immense number of vessels loading and unloading on both sides of the river; the arrivals down the river when the tide is ebbing; those from the sea when it is flowing; the various manufactories established along the water's edge, or on the declivities; the iron railways, which conduct to the place of embarkation the wagons laden with coal or lime-stone; and, finally, two handsome towns that crown this magnificent amphitheatre! This picture presents a most extraordinary contrast between nature in all its picturesque beauty and the works of ingenious and active industry.

The Wear is not, like the Humber, one of those rivers of first-rate magnitude, swelled by the concourse of other streams, and enriched by the products of an extensive territory. It receives the tribute but of a few streamlets, and is not even navigable as far as Durham, the capital of the county in which Sunderland is situated. But the banks of the Wear conceal treasures which suffice to give immense activity to its navigation; sea-coal is here found in abundance, at depths more or less considerable; sometimes near the river, sometimes

at the distance of three, five, and even six miles from it. It is brought to the water's edge by large iron wagons*, which run on an iron rail-way. Among all the roads of this kind we have been able to observe, the one in the making of which the greatest difficulties seem to have been overcome, is that which reaches the right bank of the Wear, within a few yards distance from the bridge. It presents a model which is well worthy of engaging the reader's attention†.

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* The body of these wagons is like the trunk of a quadrangular pyramid, widening by degrees. The dimensions of the bottom are five feet by six feet and a half; those of the upper base are nine by ten. Lastly, the sides, which are inclined to the horizon, in an angle of something more than 45°, are five feet two inches in breadth. The bottom of the wagon is furnished with a trap-door for discharging the load; this trap is placed nearest to that end which looks towards the ship taking in coals. It is shut by means of two iron bars, with hinges, and reaching the front of the wagon, where they are both fastened by a pin; on the removal of this pin, and in disengaging the two bars, the trap is forced open by the pressure of the load, and this load descends from the wagon between the four wheels.

There are hooks before and behind this wagon, on which the drag-rope is fixed at pleasure. The wheels, which are of cast-iron, are from two feet to two or three in diameter; their horizontal breadth is from five ten-twelfth inches, to six three-twelfth inches. They have a rim which runs within the groove of the iron rail-way; finally, the breadth of the axle-tree is from four and a half feet to five.

† The coal-pit from which this road begins, is at the distance of about six miles from the place where the coal is shipped. Although the ground through which this rail-way passes presented no very great rises, whenever they have met with a part of the soil

Opposite this rail-way, there are a great number of lime-kilns, which are erected on the rise of the hill, the sides of which form immediately above Sunderland-bridge the left bank of the Wear.

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too much broken by inequalities they have cut through them. This rail-way terminates at the steep hill, at the foot of which the Wear runs, when it joins a horizontal causeway, which leads to the upper story of a vast shed built upon the brow of this hill. This shed or warehouse, which is about 164 feet long by about 100 broad, stands at least 130 feet above the common height of the water of the river; it is divided longitudinally into three parts; two ranges of pillars form this division. There is an iron rail-way in each part, running form one end of the warehouse to the other. Hatch-ways are opened at equal distances between the iron supports of this road. The wagons arrive laden with coal, and enter in the upper story. On reaching either of the iron roads which run in the length of the warehouse, they come to a circular plate, having its centre upon the middle of the road, and turning upon it. The wagons being upon it, turn a quarter of circle altogether with the plate, and are afterwards impelled by hands along the roads, to one of the hatchways, to shoot the coal into any part of the ground-floor. Each of the three parts of this ground-floor has likewise an iron rail-way leading out of the warehouse and descending to the Wear. Two out of these three roads which lead out of the warehouse, unite into one, which a little lower unites itself with the third: they afterwards divide again into two, and again unite before reaching the point of their termination. The wagons that are laden and brought to the commencement of the descent, have first to pass over a bridge 328 feet long thrown over a deep ravine; afterwards they traverse a rock in an extent of nearly 130 feet.

Through the whole of this part, the iron rail-way is composed of flat plates, simply nailed upon large beams (*longrines,*) sixty feet in length.

The wooden bridge built upon the ravine, is bold and light. The system of its construction is simple; it is supported by small masts, planted vertically, and consolidated together by cross beams and

They are supported in front by a long and high wall, which, in its lower part, is composed of a line of arches. The chalk is brought on iron rail-ways, to the mouth of the lime-kilns*. Above Sunderland

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supports placed obliquely ; the floor of the bridge is composed of old vessels' planks.

When one wagon descends the other rises ; they would therefore meet half way, if there were but one road ; but, at this place there are two ; hence, the two wagons, to cross each other, take a different route ; after which, each follows the track which the other has quitted.

In the interval between the two rail-ways, there are, at different distances, large rollers laid horizontally, to support the ropes used to draw up the wagons ascending, or to check the impetus of those descending.

At the bottom of the iron rail-way, the wagons come to a platform built above the place where the vessels come to take in their cargo. Upon this platform, and in the centre of the iron road, there are three holes, which are the opening of three iron tubes, narrowing towards the lower extremity, and inclined at an angle of about forty degrees, and by means of which the coals are shot into the vessels. The lower part of these tubes or funnels is moveable, and fixed to the upper by a hinge. In order that the coals may not fall on the right or left, in passing from the fixed part into the moveable one, the sides of the latter are made to fit over the end of the former ; the upper part is shut at pleasure by means of a valve or trap, which is raised or let down with a lever; two ropes, one at each side of the lower part of the funnel, are fixed on the top of a small wooden stage, projecting from the platform just above the valve just mentioned. A windlass placed in this stage, serves to raise or lower the moveable part of the funnel. Thus the end of the funnel may always be put at a proper distance from the hatchway through which the ship receives the coals, although the vessel rises or sinks with the tide.

* There are many other lime-kilns, some of which are near the banks of the Wear, especially on the left side of the river ; the

bridge, the deep creeks formed by the steep banks of the Wear afford convenience for docks and building-yards. There are also glass-houses, built of bricks in a conical form: the clouds of dark smoke issuing from these furnaces; those still darker that ascend from the wharfs where the coals are shot into the vessels, the clouds of white dust rising at the moment of the unloading of the wagons which bring the lime; finally, the crash heard at intervals occasioned by the discharge of the wagons; all this forms a contrast, of which one must have been a spectator to form any adequate idea of its imposing effect.

From Sunderland-bridge to the sea, a distance of more than one mile, the river is full of vessels, from two to three-hundred tons burden; at low water they lie dry, upon a bottom of sand and pebble,

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others are at a considerable distance. In the latter, the lime is brought to the place where the vessels are laden, in the same manner as the chalk is brought to the kilns; the latter mode we shall describe more minutely.

The wagons employed for this purpose, are of the same form and structure as those employed for the conveyance of coal; they have a curb; they are drawn by a single horse, and guided by one man only, who, on those descents that are too rapid, brings this curb to act upon the wheels by means of a lever, upon which he presses. When the lime is made, it is taken out through the arches at the bottom of the kiln; it is then loaded into other wagons, which convey it at a short distance thence towards the wharf, where the vessels are loaded in the same manner as those which take in coals.

from which they do not appear to receive any damage.

The left bank of the Wear, which forms a gentle declivity from below the bridge to the sea, is lined with building yards upon a considerable extent *. On the right bank there are two building docks †, one next to the other; the water is drawn off from them by a small steam-engine, placed between the two gates of these docks. The steam of a large boiler, usually introduced in a stove for the purpose of bending planks, is, when it is requisite, used to give motion to this machine.

I remarked on the Wear, 1st, a machine for cleansing the bed of the river, put in action by steam, and similar to that in the new dock at Hull. 2ndly, a floating dock, closed by bulging gates *(portes busquées)* ‡.

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* I observed, upon a slip, a small vessel ready to be launched, with her topmasts an end; nevertheless, the construction of merchant vessels struck me as being very imperfect.

† The bottom is boarded. The blocks upon which the vessels when building, or under repair, are resting, are fixed to these boards, and to each other by staples, like those used by sawyers. The gates of both docks are held from within by shores placed horizontally.

‡ This floating dock is very large and flat. When it is to be made use of, it is necessary, at low water, to have it aground near the shore. When the tide begins to flow, the gates are opened, and it fills by degrees. At high water, the vessel to be repaired is let in at ebb tide, the gates are closed, and the interior of the dock remains nearly dry; the next tide, it naturally floats with the

The ballast of vessels is measured and shipped with buckets, the structure of which, as well as the mode of working them, deserve to be described*.

The Wear empties its waters into the sea, over a shallow, which has a slight declivity, formed in part by the mud of the river, and, in part, by the sand and shingle washed up by the sea. Before its entrance was narrowed between two piers, a bar rendered it impossible for vessels, even of incon-

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vessel, which it contains. Hand-pumps, of a very simple construction, serve to drain off the water completely from the lower parts of the interior of this dock.

* They are round and wider at the top. A large handle turns starboard and larboard, upon two small axes, placed below the centre of gravity of the bucket, when full. The upper rim of the bucket is fastened firmly to the handle by a small fork; at the bottom of the bucket is a trap, pressing upon the convexity of the cone, held by means of a hinge, and kept shut by a pin, like the traps of the coal wagons, above described.

When the ballast is to be shipped, it is brought and piled in a heap near the crane stationed at the water's edge. One of the buckets we have described is filled with ballast, of which it holds a full ton; the hook which terminates the chain of the crane is fastened to the handle of the bucket; the bucket is raised and swung by the crane, perpendicular to the hatchway of the vessel. The trap which forms the bottom of the bucket is then opened, and the ballast falls into the hold. This method is admirable, both for regulating the ballast of a vessel with precision, and shipping it with expedition.

When ballast is to be unshipped, these buckets are filled from the hold; they are raised by means of the crane, which turning, conveys them perpendicular to the bank. The handle is unhooked, the bucket turns over, and the ballast falls upon the heap formed on the bank.

siderable burden, to enter the river, even at high water. The north pier was constructed first, and more recently the southern one, in order to render the mouth of the river narrower and deeper. The immense quantity of water that flows up the Wear with the tide, to the distance of several miles, produces, at the reflux, an extremely strong current. This current has washed away the bar, and, at present, ships of four hundred tons are enabled to enter the river with the tide.

The piers are of a remarkable construction. On a great part of their length they are composed of short horizontal courses of stone, terminated, at equal intervals, by vertical timbers, fixed in the masonry. It results, from this mode of construction, that if a heavy sea should happen to destroy some portion of the courses, it would not extend its ravages further than the space contained between the two vertical beams which serve as limits to them.

At the point of the south pier is a high square turret of wood, which serves as a light-house*. About ninety feet from the point of the north pier,

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* The chamber for the lights is a demi-octagon, containing three parabolic reflectors, in a first horizontal plane; and, above, two other reflectors, in a second horizontal plane; the latter throw out their lights into the two intervals, which are not lighted, between the three lower reflectors. These reflectors have an opening of at least fifteen inches.

and upon it, is established the great light-house, that serves as a signal to vessels out at sea*.

The Tyne falls into the sea, but a short distance from the Wear; it serves equally for the exportation of coal, lime, and a number of other articles of industry. Few things can be more striking than to

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* On ascending this building to examine the lights, I counted eighty steps, about one foot high, which makes it eighty feet from the ground to the floor of the chamber containing the lights. There are, in this chamber, five reflectors, ranged on a first horizontal plane; and above, on another horizontal plane, there are four, throwing their light into the four intervals that are not lighted by the five lower reflectors; these, by their axes, embrace an arc of about 90°. The opening of the paraboloid, formed by each reflector, is about one foot two inches; the wicks are nearly one inch in diameter; which is considerably too large, has been lately proved as through many admirable experiments made by learned Frenchmen.

The glasses that cover these wicks are of a globular form; they are narrowed cylindrically below, to fit into the lamp, and above to accelerate the current of air and smoke. The windows that protect the lamps against the injuries of the external air, are composed of squares of glass, which are one foot square.

The stair-case leading to the chamber has several windows; the steps are two feet three inches wide, and the wall one foot thick. By means of the windows in the stairs, a current of air is established when the lamps are burning; then a wheel, the structure of which is somewhat similar to that of the wings of a horizontal windmill, is set in motion by the ascent of the air, and serves as a ventilator. The smoke of the lamps, which is collected into a large conic receiver, escapes through a pipe which goes from the summit of the cone already mentioned, and rises above the summit of the cupola of the tower. Each of the reflectors can turn separately round upon vertical axes, with the lamp belonging to it, and can be brought to the centre of the chamber, to be cleaned and supplied with wicks, oil, &c.

see on an extent of coast, which a foot passenger could walk over in three or four hours, two rivers which, upon an average, receive annually 16,000 vessels, and send them away loaded with the produce of their banks; hence, it will not appear surprising, if, upon this narrow track of land, the length of which is very little more than its breadth, we find six flourishing towns, the population of which is as follows:—

Sunderland	14,725
Wearmouth ?.	9,477
South Shields	8,885
North Shields	8,205
Tynemouth	9,454
Newcastle	35,181
Total	85,927

Thus, we find a population of 85,927 inhabitants devoted to commerce and industry, on the small territory we have just described!

South Shields belongs to the county of Durham, and North Shields to the county of Northumberland; they are separated by the Tyne—the first has upon the banks of this river a great number of building yards, docks for the repair of vessels, rope manufactories of considerable extent, and some very extensive glass-houses.

North Shields rises in the form of an amphitheatre, upon the declivity of a long hill. What I particularly remarked in its neighbourhood, was the

mechanism employed for the descent of the wagons laden with coals*.

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* The details I am about to give on this head, will complete those I offered on the same subject, when speaking of Sunderland.

The axletrees of the wagons used for the conveyance of coal are fixed to the nave of the wheels, by means of pins, which pass both through the wheels and the axle, which turns with them. The frame of the wagon is of wood, held together by cross-pieces, the interior is lined with iron plates; iron bars, fixed obliquely outside the plates, and between the upright pieces of the wooden frame, give solidity to the whole. When, on their way from the pit to the wharfs, these wagons meet with too rapid a descent, it becomes necessary to check their progress, which otherwise would acquire a velocity extremely dangerous. The following method is employed for this purpose.

At the top of the acclivity is a small building, composed of two walls, placed right and left of the road, and covered by a roof. Under this roof, upon horizontal beams, is fixed a wheel of wood, equally horizontal; this wheel has a groove, in which runs a rope, rather longer than the descent down which the loaded wagon has to run; below this rope, and on the circumference of the wheel, a curb is fixed, similar to those used on the Dutch mills; a single man sets it in action with a lever. This curb is held at a suitable height by vertical chains fastened upon the beams of the roof of the small building. At the moment a loaded wagon reaches the top of the descent, the man who drives it finds an empty wagon that has just been drawn up; he unhooks the end of the drag-rope, by which the latter has been drawn up, and passes the hook that terminates this rope into the iron staple, fixed in the hind part of the loaded wagon which is to go down, and before these operations are terminated an empty wagon has returned from the place of lading to the foot of the descent; there the man who drives it, finding a loaded wagon, unhooks it in order to put his horses to, and after having fixed the drag-rope to the empty wagon, proceeds on his way back to the quay.

These simultaneous preparations being finished, the driver of

Tynemouth, which is about one mile and a half distant from North Shields, is situated at the mouth of the Tyne, as its very name implies. This town stands on a promontory, very steep on the side of the sea and the river; it is protected by a fortress, and has a light-house. The fortress has nothing remarkable except its fine situation, and containing within its walls the imposing ruins of one of the finest monasteries that flourished during the middle age. The light-house is a tower, about sixty-one feet high; the promontory, upon which it is built, rises at least 168 feet above the sea*.

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the loaded wagon, which is to descend, impels it with his hand, and, springing adroitly on the side of the wagon, he seizes the lever, which serves as a curb to one of the wheels. This lever is terminated by a piece of wood, in the shape of a portion of a circle of the same radius, with the wheel, upon which it presses whenever the velocity of the wagon is to be slackened. When the driver arrives at the bottom of the descent, he halloos to stop; and immediately the person, who has the management of the great curb under the building above described, causes this curb to act. These operations are repeated for the two next wagons, one loaded, and the other empty, and so on.

* The diameter of the reflectors is two feet four inches, and their depth one foot; the diameter of the wicks is about one inch. The fires turn upon a vertical axis, which performs its revolution in four minutes. When the fires are lighted they therefore appear three times, and disappear as many in the space of four minutes. This rotary motion is imparted to them, by a system of wheels, similar to the mechanism of a clock, enclosed in a case.

The room in which the fires are, and its cupola are entirely of copper; (this metal is preferred, because it is less liable to be injured by the atmosphere, during storms, than iron.) This room is

Newcastle, upon the banks of the Tyne, stands in the midst of a country abounding in fossil coal, and is, on that account, the centre of an active commerce, and of manufacturing industry; it is the capital of the extensive county of Northumberland. Its military position was considered very important even in the time of the Romans; it was one of the principal places through which passed the great wall, built to protect the provinces of the south from the incursions of the Picts. The importance of this position was still more increased, when the country of the Scots and the Picts formed but one kingdom. Newcastle was then fortified by the English with great care, and the ancient walls flanked with towers, with which they surrounded it, and which are still remaining in a state of high preservation, are much admired. It owes the name of *Newcastle* to its fortress, which was built by the son of William the Conqueror.

In this town and its environs, is a vast number of manufactories, the extent and improvement of which are worthy of attention, such as foundries, potteries, cotton-factories, glass-houses, *&c.* It is in the

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thirteen feet high under the cupola; its base is a polygon of sixteen sides, ten of which are open. The glazing is composed of panes of plate-glass, having two feet five inches in width, and two feet seven inches in height. The height has been given in order that the brass bars which separate the plates may correspond exactly with the intervals which separate the three rows of reflectors. At the top of the cupola is a ventilator to renew the air.

neighbourhood of Newcastle that wagons, for the conveyance of fossil-coal, set in motion by steam, were first employed.

Besides being distinguished for its spirit of industry, this town is no less conspicuous for its love of science. Its literary and philosophical society publishes essays much esteemed, and possesses an extensive and well-chosen library. Of its schools I shall only mention one. On my arrival from Shields at Newcastle, and, at the entrance of this town, I observed a well-built edifice, on the front of which these admirable words of his late Majesty George III. have been chosen for an inscription! "*It is my wish that there should not be a poor man in my kingdom who is not capable of reading his Bible.*" The remainder of the inscription tells us that a free school was founded in this place to celebrate the 50th year of the reign of George III.; of George then insane, and who, consequently, was no longer in a state either to be sensible to flattery, or to recompense it. How noble and affecting is such an eulogium!

Newcastle, like Hull, carries on fisheries on the coast of Greenland; it exports iron, both in a rough and a manufactured state, but particularly coals, lead, salt, butter, tallow, *&c.*

More than twenty packet boats run regularly between this port and London; it has also others running to the principal towns of England and Scotland.

The Tyne has many building-yards upon its banks, which are almost exclusively employed in

the construction of colliers *. This river is navigable for vessels of three and even four hundred tons, to an extent of nearly twelve miles, from its mouth to the bridge of Newcastle; nevertheless the largest colliers anchor off Shields.

We may therefore consider the vast bed of the Tyne, from the bar of Tynemouth as far as Newcastle, as an immense basin, in which ships, sheltered from the dangers both of the winds and the sea, may approach either shore to take in the valuable produce of mines, manufactories, and agriculture.

On quitting this river to continue our course towards the north, we pass along the coast of Northumberland, which at present forms a county. When it ranked among the kingdoms of the Heptarchy, it embraced, as its very name imports, all

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* An idea may be formed of this commerce by the following table of the quantities of coal exported from the Banks of the Tyne:—

Years.	English Towns.	Foreign Countries.	Colonies.	Total number of chaldrons.
1802	494,488	41,157	2,844	538,489
1804	579,929	48,737	3,852	632,518
1806	587,719	44,858	1,249	633,826
1808	613,786	14,635	1,026	629,447
1810	622,573	16,951	2,310	641,854
1811	634,371	15,818	2,136	652,325

From 1704 to 1710 the annual exportation averaged only 65,760 chaldrons. It has, therefore, increased in a tenfold proportion within a century.

Thirty years since the coal trade of the river Tyne afforded employment to more than 38,000 women. According to the progress made in this branch of industry, it may be concluded that there must be 50,000 employed at present.

the territory to the north of the Humber, as far as Scotland.

The first place we meet with is the port of Blyth, at the mouth of the small river of that name; it is dry at low water, and is of very little importance.

We afterwards pass before the mouth of the Wansbeck, which is navigable to an extent of five or six miles, as far as Morpeth, which reckons 3,415 inhabitants. There, as in many other towns, Edward VI. founded a free-school, or college, which he endowed with the possessions of the convents suppressed in his reign.

In still continuing our progress to the north, we double, first, the mouth of the river Coquet, and the small island of the same name, situated opposite the mouth of the river; the Coquet is not even navigable as far as Rothbury, the only town that has been built upon its banks. Secondly, the mouth of the Aln, a river navigable only to a very short distance, at the extremity of which is Alnwick, a flourishing town, the population of which has risen to 5,927 souls. Alnwick is celebrated in the history of the wars of the middle age between the English and the Scots. It is commanded by an eminence, on which is seen the ancient and magnificent castle of the Dukes of Northumberland. Thirdly, the small island, called *Holy Island*. Fourthly, Berwick, which forms the boundary between England and Scotland.

Berwick, built upon the left bank of the Tweed, forms a county of itself, though it contains only

8,763 inhabitants. The road from London to Edinburgh, which now takes the direction of the coast, crosses the Tweed, which falls into the sea in the south of this town, by a bridge of fifteen arches. The Tweed is a rapid mountain-stream, which vessels cannot ascend, and which, at its mouth, forms only a very inconvenient harbour. It has been attempted to remedy this defect by means of a mole*, executed according to the plans of J. Rennie.

Berwick is at the same time a manufacturing and a commercial town; it manufactures cloth and stuffs of every kind, both in flax, wool, and cotton; it also possesses a rich salmon fishery on the Tweed. The fish are first sent to Shields, to be cured and salted; afterwards they are carried to London, under the name of Newcastle salmon. Berwick also carries on a fishery at sea, and trades not only along the coast, but also with foreign countries.

Such is the eastern coast of England: various are its means of commerce and prosperity; it receives through the most important rivers of which this king-

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* I observed upon the mole, a lantern of copper, for the purpose of lighting its entrance. It is composed of five burners, the reflectors of which are facet-wise, (*à facettes*) like the burning glasses of Buffon.

At the entrance of the port is a sand-bank, extending nearly from east to west, on which a Martello tower is built, to protect the entrance of the port. Berwick is fortified in the modern style; but like all English places of this kind, it is very weak on the land side.

dom can boast the productions of the different parts through which they flow, productions destined both for the English coast and the consumption of Europe. It receives also, even from Ireland, and from the western coast of England, the greatest part of their produce, destined for countries situated to the east of Great Britain.

BOOK III.

COASTS AND SEAPORTS.

EASTERN COAST OF SCOTLAND.

CHAPTER I.

General Observations. Basin of the Tweed.

Agreeably to the plan which we have adopted in our description of England, we proceed to follow the natural boundaries, indicated by the configuration of Scotland. By annexing to the eastern coast all those parts of the country whose rivers flow towards the east, we form four territorial divisions; namely, the *basin* of the Tweed; the united *basins* of the Forth and Tay; the south-east highlands, and the north-east highlands.

Let us notice, in the first place, for the whole eastern coast of Great Britain, the proportion which the population bears to the superficies of each of the divisions we have pointed out:—

Basins.		Population.	Square miles.	Inhabitants per sq. mile.	Propl. ratio. A
Thames		2,989,200	7,780	384	100
Wash		988,133	6,780	148	38
Humber		2,227,667	10,697	208	54
Northumberland and Durham		414,900	2,932	141	37
Lowlands	Tweed	92,800	1,741	53	13
	Forth & Tay	746,300	5,761	129	33
Highlands	South East	299,100	5,116	58	15
	North East	108,150	5,456	20	5
TOTAL POPULATION.					
East coast of England		6,619,900	28,189	235	61
East coast of Scotland		1,246,350	18,074	68	17

Hence it appears, that on the same extent of surface, the population of the eastern part of England and of Scotland, is in the proportion of sixty-one to seventeen*—that the most fertile part of the east of Scotland, comprehending the *basins* of the Forth and Tay, does not even equal, in mean population, the most unproductive parts of the east coast of England; and, finally, that the poorest part of Scotland is, upon a correspondent surface, five times less populous than Northumberland, and nineteen times less so than the *basin* of the Thames! These great disproportions require explanation.

With the exception of one county, bordering upon Scotland, the eastern coast of England is generally fertile—on the contrary, the greater part of the territory of Scotland is not susceptible of culti-

* The column, marked A. in the preceding table, contains the proportions of the population to the respective districts.

vation, and presents to the view nothing but rocks laid bare by the hand of time, or irreclaimable wastes. Besides, this country, being situated nearer to the pole, its climate is naturally less favourable to vegetation than that of England. In the heart even of Southern Scotland, there are districts where the cultivator is obliged to wait till the months of October and November to reap his corn; and, in some seasons, to seek, under the snow, his crop, withered by the frost before it reached maturity.

But wherever nature has with a less sparing hand supplied the germ of fertility, the Scotch have, with astonishing perseverance and indefatigable labour, brought the soil into cultivation, and the progress they have made in agriculture, since the middle of the past century, is almost incredible. In this respect, England has been surpassed by Scotland, as we will prove when we speak of the "Productive Power." Formerly the latter did not produce corn in sufficient quantity for the sustenance of its inhabitants; although the population has doubled since that time, the produce now exceeds the home consumption: the sheep and horses were scarce, small, and of a wretched breed; the horses are now large, strong, effective, and have multiplied in such a degree as to become an object of extensive traffic, and to constitute the chief wealth of the highlands.

Nature has done much to render Caledonia an important maritime state—the coasts, indented with

extreme irregularity, form extensive gulfs, spacious bays, and excellent harbours. The coasts, whose extent is commensurate with the sinuosities alluded to, and the shores of nearly 300 isles, scattered around the mainland, present an immense expansion of shore. There, isolated families and entire villages derive their subsistence from coasting, as well as from fishing, the produce of which is conveyed to the ports of Great Britain.

The stormy seas which these people are obliged to navigate, in carrying on their fishing and coasting trade, more especially in doubling the Orkneys, to communicate with the western and eastern coasts, form a race inured to the hardships, privations, and dangers incident to the life of seafaring men: in like manner the rugged mountains, the barren soil, and the inhospitable climate of the highlands constitute an excellent nursery for those brave soldiers who distinguish themselves in the front ranks of the British army.

The south of Caledonia is rich in mines of coal, a species of fuel of incalculable value in a country where the winter, with long nights, prevails more than half the year. Calcareous and siliceous stone, marble, and granite*, are everywhere found in great abundance in this quarter. Brick is seldom used in

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* Vast quantities of granite are annually exported to London and other parts of England for paving, and the erection of grand and durable edifices.

building, which, independently of the external, and, in some degree of the internal inelegance of houses built of this material, forms a striking difference in the appearance of English towns and cities, and those of Scotland. This kingdom, as will appear when we shall enter into a description of its trade and commerce, is not less worthy of attention for its enterprise and industry, than for its mines and agriculture.

Basin of the Tweed.

This division includes the counties of Berwick, Roxburgh, Selkirk, and Peebles; the first only is washed by the sea, but does not contain any sea-port of consequence. Roxburgh is contiguous to England, and bears a strong resemblance to Northumberland; the two other counties are environed by masses of mountains, which supply very scanty resources to the agriculturist. The communication with the coast is solely along the valleys, through which flow torrents too rapid for the purposes of navigation.

The valley of the Tweed, as also some of the plains connected with it, is certainly well cultivated, but its limits are too contracted to give much importance to its superficies. To the north of this valley, nature at once assumes a different aspect, and even the county of Berwick contains immense

peat grounds and wastes, the arid and dismal appearance of which presents to the traveller the picture of solitude and desolation. These observations will enable the reader to comprehend the results of the subjoined table:—

Counties.	Inhabitants.	Square miles.	Population.
Berwick	34,000	442	77
Roxburgh	41,700	715	51
Selkirk	6,800	264	26
Peebles	10,200	319	32
Total	92,800	1,740	53

Internal navigation, in the district of the Tweed, being impracticable, means have been devised for facilitating and extending carriage by land. Iron rail-ways have been proposed for opening a communication from Berwick, through the valleys of Peebles to Edinburgh, and with Glasgow, along the valleys of Selkirk. Mr. Stevenson has prepared ingenious and interesting plans for executing these enterprises—it is easy, without being conversant in civil engineering, to form an idea of the magnitude and intricacy of the plans, as well as of the difficulties which must be encountered in effecting a track or line of ways, the inclination of which ought to be almost imperceptible, through a country bristled by rugged mountains, and literally furrowed by narrow valleys and deep ravines. No company has yet been formed to carry into effect these projects, so worthy

of a nation who have already performed prodigies, in surmounting, by dint of art, the obstacles of nature.

At Kelso, in Roxburghshire, was suspended the first chain bridge for the passage of carriages, &c. *(See Vol. I,, last Chap.)*

CHAPTER II.

Basins of the Forth and the Tay.

At the extremity of the Lammermuir hills, the traveller, in pursuing his journey towards Edinburgh, enters the county of Haddington, and is struck by the sudden change in the face of the country. The valleys through which he passes are covered with verdure and luxuriant vegetation. On the left, the barren mountains, which have just been traversed, gradually diminish, and on the right the immense gulf of the Forth bordered with villages, towns, and harbours, and ploughed by innumerable vessels, contributes to heighten the beauty of the scene.

The *basin* of the Forth, though small in extent, is nevertheless the most important of all the eastern coast of Scotland, and the one whose population, compared with its surface, is the most considerable, as may be collected from the annexed table.

Counties	Inhabitants.	Square miles.	Pop. per sq. mile.
Haddington	35,000	272	128
Edinburgh	195,300	354	552
Linlithgow	23,100	121	191
Stirling	66,700	502	133
Clackmannan	13,500	48	281
Kinross	7,900	78	101
Fife $\frac{1}{3}$	38,934	158	246
Total	380,434	1533	233

The first sea-port we see in proceeding along the south-coast of the Forth, is Dunbar, containing 5272 inhabitants; the number of ships belonging to it in 1820 was thirty-six, measuring 2,450 tons; and the next, North Berwick, in the bay of Aberledy, the most convenient place for the disembarkation of troops on their route to Edinburgh. No other remarkable place is situated on the coast between Edinburgh and Leith, which forms the suburbs of that capital.

Edinburgh is no longer the residence of kings, nor the centre of government, but it is still the metropolis of Scotland, the seat of the superior courts of justice, and of the representative government of the kingdom. These establishments draw a number of inhabitants from various parts of the country, and require the attendance of a vast number of lawyers, civil officers, clerks, *&c.*, which constitutes the principal source of opulence to the capital.

After having been, for centuries, the theatre of feuds and revolutions, Edinburgh has ceased to be that of ambition, and, for want of fuel, the flame of faction has become extinct. The activity of the public mind has taken a direction to the peaceful occupation of cultivating the sciences, letters, and the arts; the result is astonishing. What is most to be admired is the progress of popular instruction, and its important effects. In the Lowlands an individual, however humble his birth, and scanty his means, who cannot read, write, and calculate, is rarely to be found;—the rudiments of learning,

within the reach of every member of the community, have afforded to all, whom nature has endowed with more than ordinary abilities, an opportunity of extending the boundaries of their knowledge, and of distinguishing themselves by their genius and acquired talents. Of this description may be reckoned those superior characters who, for the last hundred years, have enlightened the Lowlands. In the sciences—Macpherson, Simpson, Ferguson, Black, *&c.*;—in literature and philosophy, Hume, Robertson, Blair, Adam Smith, Dugald Stewart, Burns, Walter Scott, *&c.* The greater part of these celebrated men have devoted their genius and their talents to public instruction in the University of Edinburgh, to which they drew from all quarters of the United Kingdom, and even from foreign countries, a number of opulent young gentlemen, who have greatly contributed to the prosperity of that city. The elementary knowledge diffused among the lower classes has fitted the mass of the people for improving and carrying on with success the operations of trade and the speculations of commerce, which require the habitual exercise of the mental faculties; hence, in the heart of Scotland, the vast and rapid progress that has been made in the useful arts, and the combination of distinguished talents, applied to the practice of those arts, as well as to the investigation of their theory. To Scotland the true principles of political economy owe their developement and their demonstration. The most skilful civil engineers—Watt, who has made the

steam-engine the most powerful agent of productive industry; Rennie, Telford, Stevenson, Munro, Baird, and Jardine, are Scotch engineers, and no less celebrated for the public works which they planned and directed, than for the vast improvements which they made in facilitating the execution of those enterprises. Such are the sources of the glory and riches of Scotland. Edinburgh, situated in the centre of all those improvements in the useful arts, has profited more by them than any other town; it has acquired celebrity from the grandeur and the number of its public monuments, the regularity and elegance of its modern streets and houses. Here a species of luxury, the offspring of labour and assiduity is conspicuous. In these times the mansions in which the ancient nobility of Scotland resided are scarcely large enough for the accommodation and comfort of merchants. This opulence is not confined to the coffers of a few sordid capitalists, to the prejudice of men of moderate fortune; the comforts of life are extended to the lowest classes of society, and the enjoyment of these blessings has produced a surprising increase of population. In 1687 Edinburgh contained only 20,000 inhabitants; in 1821 it reckoned 112,235, so that in the space of 140 years the number had increased in a six-fold degree* !

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* We proceed to give a brief description of the topography and monuments of Edinburgh. This city is built upon three hills which run parallel with each other. The old town occupies the

We will now point out specifically the progressive improvements that have taken place in trade and commerce. Edinburgh and Leith, remarkable for the variety and value of their manufactures, are extensively engaged in the distillery of spirituous

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centre hill, which is the highest. The new town stands upon the hill on the north side, which is the lowest; and the third eminence is almost covered with the recent additions to the old town. Of the two valleys which separate the three hills, the one on the north is the widest and deepest, and once formed the basin of a lake whose stagnant waters were most injurious to the public health.

Only half a century ago Edinburgh, confined to the old town, exhibited a mass of dark and dirty houses, without regularity, destitute of taste, and exceedingly crowded upon the longitudinal ridge of the centre hill—in front the houses are seven stories high, and on the side next the valley thirteen or fourteen stories in height.

The castle, built upon the rugged rock at the extremity of the same hill, is irregular and Gothic; it is separated from the town by an esplanade. Prisoners of war, not upon parole, are confined in this fortress.

The parliament-house, which is at a short distance from the castle, has nothing to attract attention except the spacious hall (*a*) in which the commons used to hold their sessions.

At the opposite extremity of the old town is situated the royal palace, formerly a monastery, and still designated Holy-rood-house—" House of the Holy Cross!" It is a mixture of Grecian architecture and castellated towers, too irregular to be graceful, and too contracted to be majestic. The

(*a*) The carpentry of the visible roof of this hall consists of pendentives connected at intervals by pieces of wood cut into the form of a concave arch. The whole body of the vault is suspended out of the perpendicular of the walls, and bears upon the arc-boutants. This mode of constructing roofs is at once light, compact, and elegant, and might be used to advantage in many similar places:—the roof of one of the churches of the old town is also in the pendentive style.

liquors, in the weaving of kerseymeres and shawls, in the printing of calico and cloth, in making soap and candles, in the casting of iron; to which may be added the numerous paper mills in the vicinity: the printing establishments, so multiplied as to place

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The mint has nothing except its antiquity and preservation (*a*) to recommend it to notice.

Let us pause for a moment before the ancient cathedral of St. Giles's church—under its vaults, upon the ashes of Lord Napier, the immortal inventor of the logarithms (*b*).

Such are the old monuments which are worthy of some attention. The modern works are numerous, and have the stamp of good taste, or, at least, that of public utility. The bank, the exchange, the courts of justice, the libraries of the faculty of advocates, and of the writers to the signet, are grouped about the cathedral. All these buildings have been erected within the last fifty years.

Within the same short period the lake, whose insalubrious waters remained in a stagnant state, in the valley on the north of the old town, has been drained. Causeways and bridges cross this extensive valley, which is ornamented with towers, houses, and churches; thus a junction is formed between the old and the new town. The latter, laid out in conformity to a plan designed by Mr. Craig, exhibits a system of streets no less regular than spacious, and well executed. Squares for displaying the monuments, and monuments for adorning the squares, present, in their assemblage, a grand and imposing appearance, of which the finest capitals in

(*a*) Agreeably to the act of union, this establishment is kept up with all its officers, although no money is coined in it. The only use that is now made of it is to ring the bell regularly at the hours when the workmen began and left off work in the sixteenth century.

(*b*) This church, which was, in its entire state, imposing and majestic, is now divided by four partitions, and converted into four churches perfectly independent of each other. The tower of the cathedral is square, and surmounted by two open arches, which support a steeple, and represent in the air the figure of an imperial crown. The architecture is in the same style as the belfry at Newcastle, and displays, in my opinion, less boldness and elegance.

Edinburgh next to London in an art which at once demonstrates the enterprise and activity of commerce, and the propagation of knowledge among the whole nation.

These improvements are only of recent date.

Europe can scarcely furnish an idea. In Scotland no superstitious prejudice prescribes the nave of the church to be in a line from east to west; for this reason, whenever a church can be placed at the extremity of a fine spacious street, the façade is elevated perpendicularly in the direction of that street, to which it gives a majestic termination.

A fastidious critic might, no doubt, find fault with detached parts in the execution of several edifices in the new town; but the combination, I repeat, is in a style of noble simplicity, and the beautiful effects of architecture are conspicuous in the judicious order and happy site selected for most of the monuments.

The register-office (the depository of the archives of the kingdom), which Robert Adam has built in a manner which approaches the school of Palladio, is of exquisite taste and magnificent style; it forms a superb point of view to the finest street in the old town, a street continued across two valleys, from south to north, over two bridges, corresponding in width with the street. The north bridge consists of five arches, three of which are seventy-six feet and a half in span, and the two others nearly twenty feet in span. The elevation of the road-way above the bottom of the valley is fifty-four feet; the same valley is crossed by a causeway about 698 feet in length, and 210 feet wide at the summit. The materials used for the formation of this vast mound were supplied from the site of the buildings in progress in the new town.

To Robert Adam the plans of the edifice destined for the university are likewise due. This structure is conceived upon a scale too vast for the opulence of the town. Though begun more than thirty years, it will never, in all probability, be finished, unless parliament should grant from the public treasure the funds requisite for its completion. Viewed as a work of art, this structure appears to be less perfect than the register-office.

Near

Previously to the act of union, England exercised the most mischievous influence over the traffic and industry of Scotland. By prohibitory laws, she excluded the produce of that country, and by the worst artifices, she checked the footing which the

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Near to the register-office there is a third bridge, which serves as a communication from the eminence upon which the new town is built to the Calton-hill, whose base only is surrounded with houses. The new bridge, at which terminates the London road, recently surveyed and planned by Mr. Stevenson, is upon the alignement of a projected terrace, very wide, long, and in a straight line, extending to the valley of the drained lake. The city of Edinburgh is competent to defray the expenses of these vast undertakings, by tolls and voluntary contributions.

On the summit of Calton-hill a monumental tower, in honour of Nelson, was erected during the late war—the pinnacle of the rock has been reduced to form a base for the superstructure; it is of the Gothic style, extremely high, and surmounted by battlements: it commands the gulf of the Forth, and is distinctly seen from the opposite coast.

At a short distance from the commemorative pillar, stands a circular building, which was intended for an observatory, but remains unfinished for want of funds. Only a fine camera obscura has been completed (*a*). From the summit of the tower the external objects are reflected in the middle of the room, upon a horizontal plane, by means of a mirror, inclined at an angle of forty-five degrees. By causing the mirror to revolve slowly upon a vertical

(*a*) This observatory might have been completed; but unfortunately, when it was half built, Robert Adam was requested to embellish it. This architect conceived the project of giving to the edifice the appearance of a Gothic tower, because it happened to be at that time the fashion in Great Britain, to apply embattlements and *machecoulis* not only to castles, but also to dairies, cabinets of curiosities, and the boudoirs of fashionable ladies. The scanty sums in hand were soon exhausted, and this astronomical fortress, so far from being armed with optical instruments, can scarcely be kept in a state of defence to repel the attacks of the atmosphere.

Scotch were anxious to take, whether in their commercial intercourse with foreign powers or in their colonial enterprises. Thus, England, after having covertly, and by innumerable artifices, impeded the establishment of the Scotch at the isthmus of

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axis, the spectator is gratified with a view in succession of all the points of the horizon; and this view is one of the richest, most varied, and the most imposing that I know; it requires only the sky of Italy and Greece to be put in competition with the scenery so much admired on the shores of the bay of Naples, or on the coast of the Bosphorus at Constantinople.

On the right of the bridge, in the direction of the observatory, stands a circular tower, in the Grecian style; it is the tomb of Hume, the most philosophical of the Scotch historians.

At a short distance from that monument is just completed a vast enclosure, formed by thick and embattled walls, flanked by Gothic towers. Within those walls a large building of the most austere style is used as a prison for criminals; this prison is contiguous to, but without any communication with the penitentiary, for the reception of individuals whose offences may be expiated, and their vicious habits reformed by contrition, seclusion, and labour. There, in an immense amphitheatre, six tiers of small work-shops are erected along the concave side of a semi-cylindrical building, resembling the boxes of a theatre; these stalls, like the boxes, are open on the side facing the area of the hall. In the centre stands a tower, without artificial light, and impervious to the light of day; in its semi-circular wall are formed narrow and numerous apertures, through which the vigilant taskmasters can at all times see the different stalls without being seen by those that occupy them: thus the prisoners remain under the impression that an invisible agent incessantly watches them for the purpose of rewarding their care and industry, or of punishing their misdemeanour and idleness. This discipline furnishes a practical proof of the blessings which a pure and simple religion confers upon men who believe in the presence and justice of an invisible and supreme Being.

Darien, instigated the Dutch and the Spaniards to destroy that infant colony. But since the memorable era of 1707, when an united legislative body extended over both nations its solicitude and authority, the united parliament gradually abolished those prohibitory laws, which kept the commerce and manufactures of the two kingdoms in a state of constant hostility. These encouragements, liberally and judiciously given, caused the useful arts to advance with rapid strides, in the nation farthest from the seat of the government. In 1727, with the money due to Scotland, at the epoch of the union, the royal bank was founded.

In the same year, an act of parliament authorised the king to appoint commissioners for the protection of the manufactures and fisheries of Scotland, in conformity to a clause in the act of union. The sums distributed, amount annually to 4000*l.* sterling.

In proportion to our population, if French industry were to receive, from the government, assistance equally considerable, 70,000*l.* sterling would be requisite; but our budget does not even grant 8000*l.* sterling to reward and promote national industry; nay, there are even some deputies who have been known to propose and vote for the reduction of so trifling a sum. How happy I should be, if this plain comparison would make our legislators sensible to what a distant point they wander, from the true object to which their love of economy ought

to be directed! I venture to put this question to them: Can the name of economy be applied to retrenchments which give a fatal blow to the progress of national wealth?

In order to show the efficacy of the assistance granted to Scotch industry, it is sufficient to state the progressive improvement of commerce, of which increase, irrefragable proof is furnished by the official returns of shipping.

Years . . .	1692	1740	1752	1800	1820
Number of ships	29	47	68	134	213
Tonnage . .	1702	2628	6935	13,884	24,874

Thus, in the course of 128 years, the number of vessels increased in the proportion of one to seven, and their tonnage as one to fourteen! But in consequence of the improvements in navigation, and the celerity with which mercantile operations are conducted, vessels now make, in a given time, more voyages than they did a century ago, in the proportion of at least two to three, so that it is a positive fact, that since the union, the foreign commerce of Leith and Edinburgh has become from eighteen to twenty times more considerable! This result ought to attract the attention of our statesmen, more especially when they shall know that a correspondent increase has taken place in the other ports of Scotland.

The public works which are conducive to the interests of trade and commerce, ought to be reckoned

among the causes of the wealth and prosperity of the city of Edinburgh; such are the great improvements that have recently been made in the public roads, the formation of iron rail-ways for the conveyance of coal, the laying of cast-iron pipes, some for providing the town with a plentiful supply of pure water*, others to furnish all parts with the brilliant light from gas; the excavation of a canal to unite the German with the Irish sea, by the Forth and Clyde; another canal lately completed, parallel to the southern shore of the Forth, from Edinburgh to Leith, to the termination of the former at Grangemouth. The execution of this undertaking was confided to Mr. Baird†.

The communication from Edinburgh to Leith, is by a causeway about one mile and two-thirds long, and fifty or fifty-five feet wide. It forms a magnificent avenue to the capital of Scotland, of which three spacious streets, bordered by high and uni-

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* There were formerly extensive lakes around Edinburgh; they have been drained. A vast forest once stood in its vicinity; not a vestige of it now remains; but fortunately the town is only from five to six miles from a very extensive coal-mine. About the same distance there are fine springs, the waters of which are conducted to the town for the consumption of the inhabitants. An additional supply is brought from Crawley about twelve miles from Edinburgh. Iron-pipes, from fifteen to eighteen inches in diameter, are used for the purpose. Mr. J. Jardine is the engineer who directs those works.

† These aqueducts are lined with sheet-iron.

formly-built houses, diverge in the form of a fan at the extremity of the causeway. The traveller, in his progress along this avenue, is struck with admiration by the number of new edifices which are rapidly arising to adorn its sides. The ground has been marked out and disposed agreeably to a general plan, for prolonging the new town, and uniting both towns to Leith. These judicious regulations offer an example to be followed in improving every town.

Leith was formerly called *Inver-Leith*, from its position at the mouth of the Leith*. Except the modern quarter, which reaches the avenue to Edinburgh, its streets are dirty and narrow, and the houses of mean appearance. It contains 26,000 inhabitants, who, added tc the population of the capital, of which it is only a suburb, form a total of 138,235 souls.

In times of ignorance and barbarity, Edinburgh, jealous of the commerce of Leith, endeavoured to deprive it of its local advantage by the tyranny of law †. Inthe fourteenth century, Edinburgh received,

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* The Leith passes to the north of Edinburgh. In the space of twelve miles only, this stream turns eighty hydraulic wheels, for the like number of factories.

† In 1485, a law prohibited the inhabitants of Leith from entering into any commercial intercourse with those of Edinburgh; it interdicted the latter admitting the former into any mercantile partnership, on pain of forfeiting the privileges of that city for one year, to pay a fine, &c.

as a gift, part of that town, from the munificence of Robert I. The city afterwards purchased, of the feudal lord, the surrounding land, and the property of the shores of that part for the construction of vessels.

In 1777, Leith-harbour underwent great improvements. The pier, which forms the eastern boundary of the embouchure of the river, was carried farther into the sea. On the opposite side of the harbour, a quay, basin, and a dock were built. In the space of twenty years, the increase of trade rendered these accommodations insufficient. In 1801, it became necessary to commence a new dock, according to a plan drawn by Mr. Rennie, equal in dimensions to the former; it is 273 yards in length, by 109 yards in breadth, and can accommodate forty vessels of 200 tons burden *.

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* Projects of still greater magnitude are in contemplation. The entrance of the river Leith is obstructed by a sand-bank, which leaves only a depth of water of twelve or thirteen feet at flood-tide. To remedy this inconvenience, a third dock to the west of the two others, and in continuation of their line, is proposed to be constructed; it will have the same breadth as the others, with double the length; it will communicate with a very large basin, which will serve as a harbour to the village of Newhaven. On this side, vessels will pass from the bay into the new basin, then these vessels will find a channel twenty feet deep; the gates of these locks are forty-one feet wide, and high enough to keep in a depth of water of sixteen or twenty feet.

Between the sea and the two docks, a wall with bastions skirts the bay of the Forth. This wall, which is built with stones, upon ground gained from the sea, like that of the two basins, is, in point of extent, strength, and excellent workmanship, a perfect

On quitting Leith, to continue our excursion on the south side of the Forth, we pass in front of Newhaven, where Captain Brown has constructed the chain-pier which is described in the preceding volume. After proceeding about nine miles, we arrive at Queen's Ferry, situated on the principal road between Edinburgh and Perth. The police of

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model of the kind; these works are all under the direction of Mr. Robertson.

At the extremity of the basin, and close to the mouth of the Leith, two docks for the construction of trading vessels have been built. Upon the intermediate space, and for the exhaustion of their water, a steam-engine is fixed in a small building.

Another building-dock, the entrance of which is in the new basin, has just been completed; its stairs present three quadruple rows of steps, being one foot nine inches high, and eleven inches broad, which gives a total depth of twenty-one feet. The division of the quadruple rows is marked by a bench one foot eight inches broad, instead of eleven inches. The breadth of the dock at bottom is forty-four feet; the entrance is not much more than thirty-four or thirty-five feet in width. If we add to the breadth of the bottom, thirty-four feet seven inches, the horizontal breadth of the stairs, we shall have seventy feet for the total breadth at the level of the ground.

When the old floating-dock was building, a wooden swivel bridge was thrown across its entrance. An iron one, similar to those of the London and Liverpool docks, is in construction, to be placed over the entrance of the new basin. It has cost 1365*l.*; its width is twelve feet and a half. It is composed of six ribs of cast-iron, flat, and open in the middle, in order to render them lighter.

At Leith, an ingenious application has been made of iron-ways for raising ships upon slips. The cradle which bears the ship, is itself borne by a great number of small wheels which run upon inclined tracks. I have given a minute description of this piece

this important passage is intrusted to the superintendence of a lieutenant in the navy*. We next reach Borrowness, a commercial port, which reckons 128 vessels, measuring 8558 tons; and Grangemouth, at the mouth of the river Carron, and of the celebrated canal which unites the Forth and the Clyde. Grangemouth possesses fifty-eight vessels, which measure 8186 tons. Further up, the Forth

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of mechanism, and communicated it to the French navy in 1817; but this method has not been as yet adopted.

There are two stone-bridges over the Leith, each cut in the middle by a draw-bridge, such as are used at the entrance of the old docks at Liverpool.

Immediately after passing the lower of these bridges, a building recently finished appears on the right, which answers the double purpose of a custom-house and excise-office.

Leith, considered in a military point of view, is of very great importance to the defence of Edinburgh. There the French and the English landed by turns to succour or oppress Scotland. Cromwell built a fort at Leith; because *he* built it, Charles II. demolished it. What contributes chiefly to the defence of the harbour, is a battery built on the eminence which rises behind the docks, and extends beyond Newhaven. This battery, surrounded by an entrenchment, and protected by bastions at the gorge, contains the barracks for the military.

* Till very lately, the public crossed this passage in numerous sailing-boats, for which art had provided safe piers and convenient landing-places; one single steam-vessel now performs that service with still more ease and promptitude. Previously to its establishment, two plans were submitted; the first, to make a tunnel under the Forth, the bed of which is, at the passage, one mile and a half broad; the second to throw across the Strait, a chain suspension-bridge. The use of the steam-boat has rendered those bold enterprises less desirable. No company has yet been formed to undertake them.

becomes more contracted, and dwindles into a common river. The first bridge that occurs, in ascending, belongs to Stirling, the ancient capital of the kingdom. A short distance below Stirling, the Forth is divided into two branches, the one, on the south, reaches the foot of Ben Lomond; the other, on the north, receives the waters of Lake Katrine.

In descending the Forth, on the southern shore, we arrive at the port of Alloa, which reckons 142 vessels, containing 13,817 tons. We then fall in with a succession of small ports, such as Torryburn, Inverkeithing, Dalgetty, Aberdour, and Kinghorn, where passengers are landed, on their way from Edinburgh to Dundee; next, Kirkaldy, the parish of which contains only 4452 inhabitants, and which is the birth-place of Roger Bacon, Scott, the subtle doctor, and Adam Smith. In 1820, Kirkaldy and the neighbouring maritime stations, had ninety-four vessels, measuring 9982 tons.

Beyond Kirkaldy, we find Dysart and Buckhaven, which flourished when the cod-fish abounded on the coast of the county of Fife*. In the time of Philip II. of France, several Dutch fishermen, having been

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* This county, one of the most populous for its superficies, independently of the maritime resources peculiar to its position betwen the gulfs of the Forth and of the Tay, and the agricultural advantages which it derives from its fertile valleys, possesses limestone, iron and coal-mines. These coal-mines are the more valuable, as, beyond the Tay, the soil of Scotland does not discover a vestige of mineral combustible.

driven by a tempest upon this coast, the inhabitants prevailed upon them to remain. Their industry soon became so productive, that the seamen belonging to Buckhaven caught, during the fishing-season, to the amount of 25,000 cod per day.

We then double the small ports of Leven or Sconic, Ely, Pittenweern, opposite the May and Crail Island, situated at the extreme northern point towards the east. Beyond this promontory, the coast turns north-west, and we presently reach the bay of Saint Andrew's.

Saint Andrew's, built on the banks of the Eden, was formerly splendid and populous. Knox, the presbyterian reformer, and his vandal proselytes, demolished the greater part of the religious monuments which this city contained; nothing of its former splendour now remains except its university, well known for the facility with which it confers its academical degrees. Saint Andrew's formerly carried on an extensive trade. During its annual fairs, it used to receive in its harbour as many as 300 vessels.

At a short distance from this port is the mouth of the Tay, the *basin* of which comprehends,

Counties.	Population.	Square miles.	Inhabitants by the sq. mile.
Fife	77,866	316	246
Perth	141,800	2,638	54
Angus or Forfar	115,700	892	129
Kincardine . .	29,700	382	78
Total . .	365,066	4,228	127

In ascending the south bank of the Tay, we double the mouth of the Earn, a river, whose source is in the lake of that name; and, finally, we arrive at Perth.

Perth derives its celebrity from its situation. When the Romans, led by Agricola, after crossing the first chain of mountains, on the north of the Lowlands, entered the fertile valley of the Tay, in the neighbourhood of Perth*, surprised to find a luxuriant vegetation on the banks of a majestic river, they exclaimed, with one voice, and with that feeling which the love and the recollection of their far distant country naturally inspired, *Ecce Tiberim!*

Perth contains 12,000 inhabitants, whose industry is rapidly improving: calicoes, paper, leather, and cloths, in particular, are manufactured within its walls. A steam-boat descends the Tay daily to Dundee, while another proceeds in the opposite direction as far as Perth, which is the commercial centre of the south Highlands. From this point, seven different roads diverge towards the defiles of the hills and the principal valleys in that quarter of the kingdom.

* Near this city, the breadth of the river is about 590 feet; it is passed on a fine bridge of five arches, below which, the Tay forms a gulf or frith, varying in breadth. This bridge is the work of John Smeaton, father of the celebrated engineer, who planned and executed the Eddistone light-house.

It is inconsistent with our plan to enter into a detail of those objects which might be interesting to the antiquarian, the historian, and the admirer of the beauties of nature ; we shall only describe in a very few words what is found, and what is believed to be found, in the county of Perth. There may be seen, with their ancient names, many of the places rendered illustrious by Ossian, and even the tomb of that celebrated bard ; Mount Dunsinane, the castle of Macbeth, immortalized by Shakspeare ; the lake Katrine, celebrated by the bard of modern times, Walter Scott, in his " Lady of the Lake ;" druidical monuments, consisting of enormous stones placed in circles, and which, while mighty empires have risen, flourished and decayed, are still standing ; camps, military roads, the works of the Romans ; walls built by the Picts ; the foundations and ruins of monasteries and Christian temples demolished by the implacable Knox. To this list might be added a great variety of objects too numerous to be particularised, as hills, mountains, valleys, lakes, cascades and torrents, plains, chains of rocks which exhibit all the sterility of the desert and its desolation, heaths, wastes, morasses, huts inhabited by half-naked highlanders ; and, in the vicinity of the same places, like the oasis in the sands of Africa, villas built with taste, and ornamented by picturesque and diversified plantations, by limpid streams and verdant meadows. But we must return to works of art.

The channel of the Tay from Perth to Dundee, stands greatly in need of improvement; in many parts, the passage is rendered difficult and dangerous, by rapids and sand-banks.

Dundee, situated on the left bank of the Tay, comprehends a population of 30,575 souls. Public buildings, warehouses, whole streets, the houses of which are of recent erection, afford decisive proofs of a modern and vast increase of prosperity. In 1820, this port possessed 170 vessels, measuring 17,029 tons, and employed in the foreign and coasting trade, the whale and cod-fisheries, *&c.* The vessels are received in docks which are left dry at low water; besides this inconvenience, there is one still greater, they are liable to be rapidly choked by alluvions. The Tay, which is of considerable width opposite Dundee, contracts abruptly at its mouth; when the tide flows, the water enters the river with such a rush and agitation, that it causes it to raise and carry away a great quantity of sand. As the water rises, it extends over a great space, and abates of its velocity; it then drops the sand which it held in suspension, and forms banks of prodigious extent, even in the middle of the river. It produces accumulations still more considerable near the sides and in the creeks, where its rapidity is stopped; in the docks of Dundee, for instance.

When the tide ebbs, the waters take necessarily a contrary direction. They then bring into the docks a great quantity of mud from the upper part of the river. Thus, at every ebb and flow, there

are alternate deposits of sand and mud which would encumber the harbour, if art did not use means to prevent this inconvenience*.

Since 1815, works of considerable extent have been executed at Dundee, in conformity to a plan which Mr. Telford submitted for adoption. This engineer repaired the old quay, and adapted the eastern part of the old harbour to the accommodation of small coasting-vessels. To the west of that part, whence nearly all the water retires with the ebbing tide, he has constructed a rectangular dock 250 yards long, by 150 yards broad. Flood-gates will probably be constructed to close this dock†.

The government has no control over the expenditure for the works at the port of Dundee. The

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* A ballast-machine is used for this purpose; it is worked by a steam-engine.

† The walls of the quay built around this basin, were attended, in their construction, with great difficulty; but British engineers have acquired such practical knowledge in this respect, as to make them triumph over all obstacles. The stone with which these massive walls are built, was brought from quarries at a considerable distance on an iron rail-way. Contiguous to the quarry, is a small steam-engine for discharging the water and raising the blocks of stone to the level of the rail-way. It is in contemplation to make a basin, the figure of which will be an obtusangular-isosceles triangle, having for its base the long side of the wet-dock which fronts the Tay. To the east of this basin, an extensive area, intended for the site of warehouses, work-shops, and a dock, is forming by means of immense quantities of earth brought hither. Mr. Stevenson had likewise presented a plan for a harbour, consisting only of one wet-dock and basin, both rectangular.

magistracy and the principal inhabitants have joined in giving security to the bank that supplies the requisite funds. Parliament, in sanctioning the plan for these works, and the necessary expense, authorized the collection of a rate on every ton on vessels entering and going out. This rate is calculated so as to pay, at the expiration of a certain number of years, the principal and interest of the sums advanced for the completion of the enterprise. In France, we are beginning to appreciate this mode of raising supplies for public purposes, and it is to be hoped that it will soon be generally adopted.

Aberbrothwick or *Arbroath** is, after Dundee, the most commercial town in the county of Angus. The inhabitants are chiefly occupied in making osnaburghs, raw cloths, and sail-cloth; during the late war, the last-mentioned article produced annually an average of 80,000*l.* In the county of Angus alone, there are upwards of 100 factories for spinning and weaving the thread for the fabrication of sails. The English find, that the sails made of flax are stronger, softer, and more durable than those made from hemp. But since the peace, this branch of manufacture has suffered exceedingly. Many manufacturers have adopted the expedient of

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* Arbroath is built upon the small river Brothwick, near the ruins of an abbey, which are still imposing on account of their grandeur, it was the abbey of Brothwick, and by corruption Arbroath.

spinning finer thread, and making cloths for domestic purposes, instead of sail-cloth.

The harbour of Arbroath is a rectangle, defended from the sea by a wall of hewn stone on the north, and by a pier on the south side. Behind this breakwater, is the house of the keepers of the celebrated light-house on the Bell-rock; as also the signal tower by which the keepers who are on shore correspond with those on duty at the light-house.

The shipping lie sheltered from the sea in an inclosed harbour. The entrance of this harbour is closed by a floating bar or boom, which is made to come out or go into a sort of slide, formed by a double row of piles driven into one of the sides of the entrance; this bar is set in motion by a capstan. In several small harbours in Scotland, this simple piece of mechanism is used to great advantage.

Montrose is the first port we reach to the north of Arbroath. It reckons 146 vessels, measuring together 12,578 tons. This fact alone shows its importance; the town of Montrose is built on the north bank of the south-Esk, a torrent which descends with great impetuosity from the Grampian hills, and which forms near its mouth a vast bay*,

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* The proprietors of the adjoining lands had it in contemplation, to convert into arable ground a large portion of the basin of Montrose; the town magistrates consulted Mr. Stevenson, in his capacity of engineer to the Royal Burghs, on the proposition for dimi-

the entrance of which is very narrow. Over this entrance, is constructed the bridge which leads to Montrose*; it is constructed in wood, and has in the middle a very large draw-bridge to permit the shipping to enter the bay. Beyond the bridge, and on the side looking towards the sea, begins the quay, near which, at high water, vessels from 300 to 400 tons may come. They ride there in perfect safety, being sheltered on the north by the town, and on the south by hills rising on the opposite shore.

The mouth of the river, filled with rocks on one side, presents on the other a shallow bottom of sand without consistence, which extends several miles into the bay. When the wind blows east, this sand-bank threatens to overwhelm the harbour of Montrose; but when the tide ebbs, the current of the Esk repels it. Montrose comprehends a population of nearly 10,000 inha-

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nishing the extent of the basin. This engineer was of opinion, that all the water collected in the basin at every flux of the tide, was beneficial to the harbour of Montrose. If the drainage proposed by the land owners had been allowed, the natural impulse of the water would be no longer sufficiently powerful, and the harbour would, of course, be choked.

* It is 244 yards long; the piers and arches are of wood, except the two side arches. Worms, of the genus of the *Oniscus*, have much damaged the wooden piers, especially on the side looking towards the sea. It was found necessary to change a great number of piles, some of the new ones have received a coating of paint, and some have been covered over with thin planks of a harder sort of timber.

bitants, remarkable for their industry; their principal articles of manufacture are osnaburghs, sail-cloth and cloths, for domestic purposes.

The north-Esk runs parallel to the south-Esk, and empties itself into the sea, a little to the north of Montrose. A stone bridge*, well executed, forms the passage across the river. This impetuous torrent serves as the boundary of the county of Kincardine, which affords very little scope for navigation. It has only the small port of Gourdon, which has lately been improved; next to it is the village of Inverbervie, which possesses a few fishing-smacks at the mouth of the Bervie; and lastly, the town of Stonehaven, at the mouth of the river Carron.

Stonehaven, or Rock harbour, is a small port well sheltered, and formed by a natural gap between the rocks; but unfortunately its water has not depth enough.

Behind the whole of the coast which we have just surveyed, a valley rises almost imperceptibly from

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* It is the bridge of Moneykirk, and the work of Mr. Stevenson; it has four arches; and with its approaches, it cost 10,000*l.* Much difficulty was experienced in laying the foundation of the pier in the stream, with a coffer-dam placed at eight feet ten inches under the surface of the water. In order to effect this object, recourse was had to a very tenacious reddish clay which the neighbourhood produced. Of this the dam was formed around the site of the piles; it checked all filtration during the laying of the foundations, and was found less pervious and less expensive than a common dam.

Stone-Haven to Perth; it is the valley of Strathmore, which the vale or strath of Earn prolongs. The total extent of these two valleys is about 112 miles, on a breadth of five. This stripe of low land wants only lime for manure, and coal for fuel, to be able to derive, from agriculture and manufactures, an abundant produce. Mr. Stevenson has submitted plans of canals and iron rail-ways upon the same level, from Perth to Stonehaven, pointing out, at the same time, the possibility of a prolongation as far as Aberdeen. Branches would communicate from the principal line to Arbroath and Montrose. This enterprise, too vast, perhaps, for the means of the land-owners of that beautiful tract of country, is worthy of national aid.

CHAPTER III.

Light-houses of the Forth and of the Tay.—Bell Rock.

The gulfs of the Forth and the Tay are lighted by a well-combined system of lights; of these the principal is the pharos on the Bell Rock*. In 1817,

* Opposite to Leith, on the small island of Inchkeith, a small light-house has been built, and a second on the isle of May, at the entrance of the Forth. A signal, or beacon, is placed upon the Carr-rock, near Cape South, which separates the gulf of the Forth and Tay; a third light-house is erected on Cape North, which bounds the embouchure of the Tay; the fourth, and the farthest advanced in the sea, is the pharos of the Bell-rock—let us point out its importance.

The Forth and the Tay are situated at the bottom of an immense gulf, the south-east coast of which belongs to the counties of Fife, Haddington, and Berwick; and the north-east coast to the county of Forfar. Attracted by commerce, or impelled by the violence of the east wind, ships coming from the German Ocean, or the north of Scotland, from Norway, the Baltic, Denmark, or Holland, are exposed at twelve miles from the coast, and in front of the mouth of the Tay and the Forth, to a vast reef of rocks, which are the more dangerous as they are visible only at low water. During the quadratures, when the sea does not fall so low at the reflux, the tops of the rocks are scarcely discernible, during the high tides; the part visible at low water is 142 yards in length, 200 feet in breadth, and about four feet in height; quite close a chain of rocks still lower, and extending one mile and two-thirds, makes its appearance. It is affirmed, that in order to warn ships off

I inspected it with the greatest attention, which enabled me to give a detailed account of it.—I can now render that account still more copious, by a communication, with which Mr. Stevenson, the architect who built the pharos, has kindly favoured me, containing the first sheets and first impressions of the plates of his forthcoming work on this edifice: the expenses attending this publication will be defrayed in part by the commission of the northern light-houses, an institution which requires only to be known to be appreciated.

At the epoch of the union, the maritime commerce of Scotland was too contracted to defray the expenses of erecting and maintaining light-houses. After the rebellion of 1745, when the government became sensible of the vast importance of promoting the physical amelioration and civilization of the Highlands, and of the dependent islands, they turned their attention towards procuring to navigators, in general, this powerful means of safety. The convention of royal burghs, which constitutes the provincial assembly of Scotland, directed its attention to the subject, and, on recommending the measure to the consideration of parliament, it was eventually adopted. An Act of 1786, 26 Geo. III. chap. 101, constitutes "the commission for the light-houses on

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this vast cluster of rocks, the monks of Arbroath, in the fourteenth century, caused a large bell to be placed upon the principal rock, whence it was called the *Bell Rock*.

the north of Great Britain, composed of the Lord Advocate, the Solicitor-General of Scotland, the Deputy Sheriffs of the maritime counties, and the principal magistrates of several royal burghs*.

At the instance of the Commissioners, authority was obtained for raising a duty on tonnage, for the erection and service of the light-houses—a duty which will be gradually reduced, as the buildings shall be completed, and when no further expenses shall be required, except for maintaining them. In the space of a few years, eight of the principal promontories on the eastern and western coasts, including the Orkneys, were provided with light-houses, built under the direction of Mr. Smith, the then engineer to the Commissioners; and, finally, the savings of the commission were put in reserve for erecting a pharos on the Bell-rock.

In the winter of 1799, a tempest, memorable for its violence and fatal effects, drove from their anchors all the ships that were lying in Yarmouth Roads; the greater part of them were wrecked on the northern coast; many of them would have been

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* The functions of the commissioners of the northern light-houses are most honourable; their services are gratuitous, and their administration shows their disinterestedness. It is conducted on a far more economical plan than that house which is charged with similar duties on the coasts of England—the latter is an old institution, and, as such, carefully retains all its good and bad qualities; for our servile veneration for antiquity consecrates equally what is worthy of preservation, and what ought to be reformed.

saved, had they found lights on the Bell-rock, to point out the entrance of the gulfs of the Forth and of the Tay. The utility of such an erection was felt and acknowledged, and preparations were made in earnest for that great undertaking. In 1803 a bill for the purpose was brought into parliament, but the bill did not pass until 1806: the act sanctions the raising of a rate of three halfpence per ton on British vessels, and double that on foreign vessels, when they touch at or depart from any part of the coast between Berwick and Peterhead. Twenty thousand pounds being already in reserve, a loan, to the same amount, was sanctioned by the legislature; with these first funds, the arduous work was begun and eventually completed, at an expense of sixty-thousand pounds. Several engineers submitted plans; but by the advice of Mr. Rennie the model and dimensions of the Eddistone light-house were adopted with the improvements on lighting, which the recent progress in optics allowed to make. *(See plate.)*

In July 1807 a vessel was directed to be moored close to the Bell-rock, which served as a light-house to the shipping and a shelter for the workmen, when the sea covered the rock. This vessel was so well secured that it remained four years on its station, without experiencing the slightest accident. It had three masts of unequal height, each of which was surrounded by a circular lantern, containing six lamps, with a correspondent number of small reflectors, plated with silver. In the spring of 1807 large blocks of granite were brought from the county of Aberdeen, which were for the coating of the lower courses of the light-house, to the height of twenty-nine feet and a half; the neighbourhood of

Dundee produced a stone of an excellent quality *(grès)* for the rest of the masonry, except for the cornice and the parapet of the lantern; the stones for these parts were brought, cut into proper shape, from a quarry in the vicinity of Edinburgh. A yard, established at Arbroath, served for the keeping and preparing of the materials, as well as for the lodging of the parties of workmen, who used to relieve each other on the rock, being obliged to work by night and day. The necessary preparations having been made, operations upon the rock were commenced in August, 1807. The first concern of the architect was to construct a place of refuge for the men, in the possible event of some accident happening to prevent the arrival of the service-boats from the shore. In laying the foundation of the edifice, the men could work only at the low water of spring tides, and for the space of two hours and a half, or three hours at most—they were therefore obliged to be at hand to take advantage of that short interval, either in the day or at night. Towards the close of October, the platform of the asylum was finished*, but the house itself was not finished before 1808. A communication between the house of retreat and the rising edifice was made by means of a wooden bridge, which served also as a scaffold for receiving the blocks of stone destined for the lower courses.

In 1808 a service-barge was moored, near the rock, to facilitate

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* The plate which represents the pharos gives, with explanations, the plan of the frame-work of the carpentry used in erecting the house of refuge—the lowest story served as a forge, and had a space for mixing the mortar for the building. The kitchen occupied the division immediately above; the next story was fitted up for the accommodation of the architect and the conductors of the works; above it were the workmen's barracks, which contained rows of hammocks five deep. In mild weather the inhabited parts of this modern ark were not assailed by the waves, but the lowest story was frequently inundated; the concussions of the sea used, in boisterous weather, to overturn their lime casks, and even the blacksmith's anvils.

the embarking and disembarking of the workmen. This combination of arrangements allowed the operations of the second campaign to commence earlier and to close later than those of the first. The foundations having been cut out of the solid rock, the first stone was laid on the 10th of July, 1808. Iron rail-ways were next fixed upon the rock, to facilitate the conveyance of materials from the landing-place to the site of the tower. Before the cessation of labour for the season, the four first courses, measuring together five feet and a half high, were completed, and did not suffer the slightest injury from the tempestuous weather in the winter.

In 1809, the mooring chains and buoys necessary for the vessels which brought the materials were put down; an apparatus for unloading the stones, and another for raising them on the building, were fixed; finally, the masonry work was raised to a height of thirty feet, which completed the solid part of the building.

In 1810, the stones having been previously hewn, fitted, and numbered, in the yard at Arbroath, little more remained to be done, except conveying, disembarking, and laying them—operations which the sailors and workmen had learnt to execute with surprising dexterity and rapidity, notwithstanding the peculiarity of the situation, and the occasional roughness of the weather. The operations in every department were conducted with so much order, promptitude, and effect, that, in October, the upper part of the masonry was completed*. In December the lantern which

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* The two first courses are incased into the rock. The Plate shows how the stones are dovetailed, in order to form a solid mass, all the component parts of which are connected from the centre to the circumference. The consecutive courses are also joined together by stone mortises. In order to prevent the blocks from being moved by the force of the sea, when the works were in progress, two holes were cut in each stone of the part entirely massive, which corresponded with two others, cut six inches deep, in the course immediately under. Stakes, about two inches in diameter, were driven into these holes, according to the method adopted by Mr. Smeaton: the cement used was, like that for the

had been previously made and adapted in Edinburgh, was placed upon its elevated position. It is an octagon, formed by a cast-iron frame, with a glazing of plate glass; it is covered with a dome in copper, and surmounted by a large gilt ball.

Eddistone light-house, a composition of pozzolane, earth, lime, and sand, in equal proportions.

The edifice is of a circular form, composed of blocks, weighing from 4500lbs. to 5500lbs. The lowest course is forty-two feet and two-thirds in diameter. The building diminishes gradually in circumference, as may be seen by the figure representing it, so that, at the summit, the parapet of the lantern is only thirteen feet in diameter—the total height is above 115 feet. The entrance door is thirty feet above the solid part; the approach to it is by a ladder, the sides of which are of rope, and the rounds of wood; it is let down, at low water, and drawn up into the building, when the water covers the rock. Women and men unaccustomed to this mode of ascending are hoisted up in a sort of chair by a small moveable crane, which projects on the outside of the entrance.

From the threshold of the door, a narrow passage leads to the stairs, thirteen feet in height—in this part of the tower the wall is seven feet in thickness; this dimension diminishes from the top of the stairs to the wall that supports the lantern, where the masonry is only one foot in thickness. The upper half of the edifice may be considered as divided into six apartments, for the accommodation of the keepers, and the keeping of stores necessary for the establishment. The lowest, or first of these divisions, is at the top of the stairs, of which mention has just been made; this story is chiefly occupied by water-casks, fire-wood, and other bulky articles; the second story is reserved for the cisterns of oil, glasses, lamps, and other articles requisite for the lantern; the third serves as a kitchen; the fourth as a dormitory; the fifth as a library and reception-room for visitors; and, finally, the sixth, or highest apartment, is the chamber occupied by the lights.

The floors of the different stories are paved with stone. The communication from one to another is by wooden ladders, except in the upper chamber, where, every accessory article being required to be fire-proof, the stairs are of iron. In each of the two

On the 2d of February, 1811, the pharos was lighted for the first time. The light is brilliant and powerful, and may be seen, when the sky is clear, very distinctly at eight leagues' distance—the light is alternately red and white*.

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lower apartments, there are only two windows; but the upper divisions have four each; the window casements are all double, glazed with plate glass, and externally defended for the night, or during tempestuous weather, by a wooden shutter. The wall which serves as a parapet to the lantern is nearly six feet high; it has a door which leads out on the balcony, supported by the cornice made round the upper part of the edifice; the balcony is surrounded by a cast metal railing, fixed upon bronze feet.

In the kitchen, there is a sort of grate, or fire-place, of cast-iron, and a funnel of the same metal, for the escape of the smoke—this funnel reaches the highest story, passing through all the intermediate apartments, which the smoke warms in its ascent. The doors, the partitions, the stairs, the bedsteads, and generally all the furniture, are neatly finished.

* The light is from oil gas, and the lamps are upon Argand's principle—the reflectors are, as usual, of copper, plated with silver; they have two feet aperture, and the distance from the focus to the summit of the paraboloid is four inches and a half. The distance from the summit to the plane of the aperture, namely, the depth of the reflector, is about one foot. The circular wicks are $\frac{9}{12}$ of an inch in diameter.

The reflectors are fixed upon a large iron frame, which presents four vertical faces or sides—the reflectors which repel the white light, without decomposition, are ranged upon the two opposite faces; they are seven in number, six at the angles of a hexagon, and the seventh in its centre. Upon the two other faces of the frame are five reflectors, the light of which passes through red glasses; they are thus arranged; four at the angles of a square, and the fifth in the centre.

The distance from the plane of the cavity of the last-mentioned reflectors to the coloured glasses is about two inches. The glasses are somewhat convex on the outside, in order that they may better resist any external concussion. In order to preserve them in their

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At the time I visited Scotland, in 1817, the engineers having in France the direction of the maritime works, as well as our seamen, thought it impossible to obtain coloured lights that would preserve their tint distinctly to a great distance. In order to ascertain the fact, I was most particular in observing the lights on the pharos of the Bell-rock; and for the attainment of that object, I had every facility I could possibly desire. Detained eight days on the coast of Arbroath, on account of the contrary winds, which did not allow me to land upon the Bell-rock, I have at different times minutely observed the lights in the evening, in the night, and in the morning, in complete darkness, and in clear moonlight, and in no case could the two sorts of light be mistaken or confounded*.

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place, their edges are inserted in a rim of copper, consisting of two flat rings applied on each side of the glass, and fastened to each other with screws.

These coloured glasses are made in London. They are of common crown glass, about the fifth of an inch in thickness; their diameter is equal to the opening of the reflector; it ought to be equal to the diameter of the section made by the plane of the glass, in the prolongation of the paraboloid which the reflector represents—by this means the copper rim of the coloured glass would not intercept any part of the reflected rays. The price of a glass with its copper rim is 9*l.* 14s. sterling.

* The white light shines longer than the red; it continues visible nearly ten seconds; its brightness, at first feeble, increases gradually, shines an instant with the most vivid effulgence, and then decreases with the same regularity. An instant intervenes without any light being seen; then, the red light begins to appear, it in-

Of the Mechanism which imparts Motion to the Lamps fixed in the revolving Frame.

The frame is of iron, and as light as it can be consistently with the requisite solidity; it revolves upon a vertical axis in the centre, by means of a system of cogged wheels, which can be engaged and disengaged at pleasure, as one of them may be displaced by slipping along the axis of the frame just mentioned. The revolving frame, which has four faces, or sides, performs a complete revolution in six minutes, so that every three minutes a white and a red light is diffused to all parts of the horizon; at first a greater rapidity had been preferred, but the alternate appearances of white and red lights were too frequent, and these different lights were not visible at sea, long enough to allow the seamen an opportunity of properly distinguishing them.

To supply the chamber with fresh air, ventilators communicating with the lower stories, terminate vertically in the chamber, against the lateral surface of the wall. The tube conductors of the smoke of each lamp converge in a larger pipe, which passes through

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creases, shines in the most brilliant manner, decreases, and is succeeded by a momentary darkness, which the white light dissipates again.

The appearance of the red light is of shorter duration than that of the white. This singular phenomenon necessarily proceeds from the greater diffraction of the red light—I have remarked that the latter, at the distance of twelve miles from the pharos would sensibly differ from the colours of the glasses, which are of a red, bordering upon the orange; the light, seen from a distance, is, on the contrary, of a pure red, or even inclining to purple; this difference may possibly be attributed to the bluish tinge of the atmosphere traversed by that light; the light of the moon has no effect upon the two lights, and scarcely any upon their intensity. At twilight, the white appeared to me to be less pure, and the red more brilliant; the degradation became the more perceptible as the day advanced.

the summit of the turning frame, and carries the smoke above the space traversed by the rays of the reflected light. This smoke is dispersed under the cupola which covers the chamber, and ultimately escapes through a vertical pipe in the centre of the cupola; the smoke thus conveyed and dispersed serves, during the winter, to keep the temperature of the chamber in a sufficient degree of heat to prevent the oil of the lamps from congealing before it reaches the wicks. The funnel of the lower chimnies, in passing through the chamber, contributes also to accomplish this object. The casements for receiving the panes which form the glazed enclosure of the chamber, as well as the cupola, are of copper, a metal which has had the preference, on account of its being less liable than iron to decomposition from exposure to the weather.

As the last mode of warning the seamen, when a cloudy atmosphere prevents them from descrying, in time, either the pharos or the lights, two large bells, each weighing 1324 pounds, are tolled day and night, by the machinery which imparts motion to the reflectors*. In foggy weather, the sound of these bells reaching far beyond the limits of the rock, ships are warned to keep at a distance, long before the light of the pharos can be seen. Particular signals establish a communication with the shore†. The duties of the establishment are per-

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* A horizontal axis, revolving by the effect of the same motor which turns the fires, has a crank or catch which lifts alternately two hammers, which, in falling, strike by turns, two bells placed one south, and the other north of the lantern. Every half minute one of the bells is heard.

† The signals used in corresponding with the station on shore, are made with a ball painted black, through the centre of which a

formed by a superintendent-keeper, his deputy and two assistants *. There is, beside, for the conveyance of provisions and stores for this and the light-houses of Inchkeith and the Isle of May, a cutter of fifty tons burden.

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vertical staff or mast passes. This staff is made fast to the cupola, above which it rises considerably. According to the position of the ball at the foot, top, or middle of the staff, three different signals are made, indicating whether the keepers of the light-house are in want of anything, or of assistance. A flag, hoisted to the head of the mast, means that the sea is high enough and sufficiently calm to allow people to land upon the rock. From the light-house, the ball, used for the shore signals, is seen against the hills rising above Arbroath. It is gilt, which does not render it sufficiently visible: it might have been better to have painted it dull white, than to give it the brilliancy of metal. The mast or staff is surmounted by a paratonnerre.

* The keepers receive respectively, sixty, fifty-five, and fifty guineas a year; and every third year, a complete suit of apparel, in common with all the keepers of the northern light-houses.

When the keepers inhabit the bell-rock, they have a stated ration of bread, beef, butter, vegetables, oat-meal and barley-meal; they have beside, small beer and about 3¾*d.* a day, to buy tea and other *necessaries.*

In Arbroath, a row of houses, where each keeper has three apartments for himself and family, has been built. An enclosed garden is annexed to each tenement. Contiguous to these habitations, a signal tower about fifty feet in height has been erected for the purpose of corresponding with the pharos. At the summit of the building, is an observatory provided with an excellent telescope. Three of the keepers are always at the Bell-rock. The fourth, who is at liberty on shore, is intrusted, during his leave of absence, with watching in the signal tower. When the weather permits the regular changes, each keeper remains alternate six weeks at the light-house, and two on shore.

The keepers of the light-house make regular observations on the weather with the thermometer and barometer. They keep a diary * of the direction and force of the wind, *&c.* They have a small library, composed of good works, on literature, morals, and natural history; they take in one of the scientific journals, published monthly. Thus, mere working men beguile the leisure hours of their solitude upon a rock in the middle of the ocean, in endeavouring to follow the progress of reason and human understanding. It is by a great number of remarks of this kind, made on the spot, that I have been able to convince myself of the diffusion of knowledge among the Scotch.

The Bell-rock is a practical school, where beginners make an apprenticeship rather severe. They remain at first several months upon the rock; then they are allowed to go on shore, in rotation, with the other keepers. When they become expert at cleaning, trimming, and placing the lamps and reflectors, they are sent as assistants to other establishments in the jurisdiction of the commissioners; and as vacancies occur, they are appointed chief superintendents.

The keepers enter upon their register the name

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* They commit to their diary, observations on the barometer and thermometer, the state of the atmosphere, the power and direction of the wind, *&c.*, and this they do every time they are relieved; for they keep watch the same as the helms-men at sea; each watch is of four hours.

of every visitor, and request him to subjoin to it a few words expressive of his sentiments on the subject of this noble edifice. I did not find anything remarkable in that singular album, except an *impromptu* of six lines, by Sir Walter Scott, the celebrated Scottish bard, to whose genius the most delightful spots in this picturesque country owe a celebrity which the magnificence and even the sublimity of their scenery could not confer. I will transcribe them :—

> " Far in the bosom of the deep
> O'er the wild shelves my watch I keep—
> A ruddy gem of changeful light,
> Bound on the dusky brow of night;
> The seamen scuds, my lustre hails,
> And seems to strike his timorous sails."

CHAPTER III.

South-east Highlands of Scotland.

In this division of the East of Scotland are comprehended

Counties.	Population.	Square miles.	Pop. per sq. mile.
Aberdeen	158,500	1,966	80
Banff	44,400	647	61
Moray, or Elgin . .	31,800	480	66
Nairn	9,200	291	31
Inverness ⅗ . . .	55,200	1,821	30
Totals	299,100	5,205	53

The maritime commerce of the south-east Highlands is considerable, as will be proved by the following extracts from the registers of shipping, belonging to the under-mentioned ports, in 1820:—

	Ships.	Tons.
Aberdeen . . .	374	51,852
Banff	160	7,093
Inverness ⅗ . . .	65	3,704
Totals	599	62,649

Aberdeen is the first maritime town of consequence at which we arrive, in prosecuting our journey.

Two rivers, the Dee and the Don, after receiving the waters of a great number of tributary torrents, empty themselves into the sea, at the distance of about three miles from each other. Old Aberdeen is situated on the banks of the Don; the new town on the banks of the Dee. The joint population of the two towns amounts to 47,796 souls.

There is nothing remarkable in the old town, except its churches, several of which are now but a heap of ruins, escaped from the hands of the reformers; and King's College*, which was formerly under the direction of the celebrated Boëtius. The library belonging to this college receives regugularly a copy of every work published in Great Britain. The University of Aberdeen, not possessing, like that of Edinburgh, literary and scientific journals, calculated to propagate its fame among all civilized nations, is much less known; nevertheless, this establishment is highly estimable. The college of the new town, called Mareschal College, has the

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* The collegiate church exhibits a square tower supported by eight counter-aboutants, in continuation of the two extremities of each side; the whole massive. Above this solid part rises, with its peculiar elegance, an assemblage of open masonry like the ornament on the tower of the church at Newcastle and St. Giles's in Edinburgh. Two arches in diagonal position, springing from the four angles of the summit, in order to sustain an octagonal turret, ornamented with eight small detached pillars, which bear six semicircular arches; and lastly, the turret is surmounted by a crown, cut in stone, with eight branches, and above it a ball and cross. This is the figure of the crown worn by the kings of Scotland.

best cabinet of natural philosophy in all Scotland, with an observatory well-provided with instruments. We must add, that all the inhabitants of this town in general have received a useful education*.

New Aberdeen is in a far more flourishing state than the old. Everywhere within its walls the eye is struck with its increase and improvements. It is spacious and well built; the principal streets are adorned with fountains; the bridges, houses, and edifices, composed chiefly of granite, have a beautiful appearance. The operations of its commerce and navigation will reveal the mystery of all this prosperity.

The entrance of the Don †, below old Aberdeen, is almost obstructed by a natural bar or bank, which will only admit of the passage of small boats. This obstruction has occasioned the gradual migration of the inhabitants from the old to the new city, on the

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* In the account of my second tour, *Memoires sur la Marine*, &c., I took notice of the fine optical and astronomical instruments made by Mr. Ramage. I ought to have added, that this self-taught engineer understood perfectly the principles of his mechanical operations.

† At some distance above Old Aberdeen, a wooden bridge, of elegant structure, has lately been thrown across the Don. It consists of two arches, fifty feet in span; the intermediate piece consists of a single row of piles; the abutments are of stone. Near this bridge, the canal from New Aberdeen to Inverary strikes into the valley of the Don; it may be considered as a lateral canal to that river. Its main object is the conveyance of manure, and of the produce of the soil.

banks of the Dee. This river has, by its allùvions, formed a low island, the form of which is semi-circular on the side of the town, and which terminates in a long straight point on the other. At the extremity of this point, and before entering the sea, the two arms of the river meet again.

Only thirty years ago, might be seen, beyond the embouchure of the Dee, a sand-bank, so formidable as not to allow even small craft to pass without difficulty; but art has triumphed over that natural obstruction. Ships of 400 tons can now enter the harbour of Aberdeen. On the left bank of the Dee, Mr. Telford has lengthened, by nearly 300 yards, a mole, bearing S.S.W. to N.N.E., originally built by Mr. Smeaton. Its breadth, at the summit, is eighteen feet, and its length 492 yards; it is formed of blocks of granite hewn with extraordinary care*. A light-house, built upon the mole, shows the entrance into the harbour. On the opposite side of the river a break-water has been erected. This massive wall has a very gentle slope: it is of a circular form, and opposes its convex side to the waves. Notwithstanding these great works, the neighbouring coast is so exposed to the waves of the north sea, and the current of the Dee, which runs towards the south, occasions such a deviation from the right course, that vessels, when the winds are contrary, find it extremely difficult to make the harbour, and to avoid running on shore.

We will now quit the Mole and ascend the Dee, on its semi-circular bank, which art has lined, on a considerable part of its extent, with a fine quay. We first meet, along this quay, with large factories for the preparation of whale oil†. Behind all

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* The Scotch alone know how to cut granite with precision and expedition.

† For the removal of the enormous casks filled with train oil use is made of carriages, having above their axle-tree a set of

these warehouses, the downs which overlook the beach between the two Aberdeens are situated.

Two docks or basins, excavated in front of the train-oil warehouses, are exclusively used for the accommodation of the large vessel employed in the whale-fishery. Further up, a number of vessels are lying at anchor; and most of them, are a-ground at low water. Most of these vessels usually bring coal and coke, and take in return cargoes of granite.

A few years ago, vast projects were in contemplation for the improvement of the harbour. To prevent the vessels from grounding, which makes them much less durable, and, to enclose them in a place where they would be safe from robbery, it was intended to excavate a spacious basin in the semi-circular island beyond the quay; but the expenses of the mole and the quay absorbed all the funds that could be disposed of, and the enterprise was indefinitely postponed.

Near the middle of the quay, there is a basin which has no communication with the Dee; it is connected with a series of locks which form the commencement of the canal of Inverary*. It

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cogged wheels, which impart an equal motion to two barrels, of equal diameter, parallel with the axle. On these barrels are rolled up, but in a contrary way, the two ends of a long chain, which admits of tightening or extending at pleasure. A chain, like this, is fastened at each end of the barrel, and close to the wheels of the carriage. To move a cask, the carriage is placed in such a manner as to have it between its wheels: the chains are then slackened, until the hook, in which each of them terminates, reaches the ground. The chains are next fastened under the cask; then, with the wynch, which sets the cog-wheels in motion, the two chains being tightened, they raise the cask, which is afterwards carried to its destination.

* The width of the locks of this canal does not exceed nine feet ten inches—the barges that navigate on it are from six feet six inches to seven feet four inches broad; their sides are

passes behind the Downs, to the east of New Aberdeen, and to the west of the old town. Along this canal, and going from the basin to a considerable distance, there is an iron rail-way. Close to the basin, there are places for breaking lime-stone. Near this spot, slabs, paving-stones, blocks of granite are landed, and put on board vessels bound for England; the county of Aberdeen alone exports annually 12,000 tons of granite, for the south of Great Britain.

Between the train-oil establishments and the basin of the canal of Inverary, there is a range of building yards close one to another, and extending to the edge of the quay. In the harbour of Aberdeen, we observed a fine floating ballast-machine worked by steam. It is capable of drawing, in one day, 300 tons of ballast; but it draws most commonly, from 150 to 200 tons per day.

In continuing our journey along the coast, from Aberdeen, we pass the village of Newburgh, at the mouth of the Ythan, a river on which a considerable pearl-fishery was formerly carried on. We next proceed north north-east, as far as Peterhead, the most easterly point of Scotland. *Peterhead* contains 4783 inhabitants; it is built on the edge of an extensive bay, which affords secure anchorage to ships of all sizes. In its neighbourhood, there are celebrated mineral waters, which add to the prosperity of the place. In summer and autumn, a number of opulent families visit Peterhead to take the sea-water baths, and to enjoy that variety of amusements which are to be met with at watering-places.

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long and rectilineal, except towards the ends, where they are curved, to form the head and stern.

Smeatón has built the moles of the port of Peterhead with granite. The inhabitants had agreed with the commissioners of the Highlands to blow up 30,000 yards cubic of rock, for the purpose of deepening the harbour, an undertaking which was to have been finished towards the close of 1811; but it has not been attended with complete success. Wooden cases, forming a sort of moveable cofferdams, were used; in the interior of them, the workmen exhausted the water and went on with their work without any difficulty. Excavations to a considerable extent have been made; but they have not been made level.

Besides the old harbour, which is to the south, a new harbour has lately been built to the north*, to enable vessels to enter the harbour of Peterhead, from whatever point might be the direction of the wind. The trustees of the harbour† have laid out 15,000*l.* upon these works. The commissioners of public roads in the Highlands, whose duties we shall explain hereafter, have doubled that sum, from the funds placed at their disposal by Parliament.

By turning successively towards the north and west, we reach Cape Kinnaird, upon which a light-house was built as early as 1787; it is the first that

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* The north jetty extends 168 yards, in reckoning from the high-water mark, and half this quantity in reckoning from the low-water mark. The interior wall is built upon caissons; the head of the jetty turns off towards the west. It is eighty feet long; it is founded upon caissons also, at a depth of ten feet under low-water mark. This height of water, with the assistance of the tide, is sufficient to float the largest ships employed in the Greenland fishery. A portion of the jetty, before it was finished, was blown down by a tempest, in 1819; it has since been re-built upon a wider, and consequently more solid base.

† The ground and harbour of Peterhead belong to the hospital of the daughters of tradesmen of Edinburgh.

the Highlands possessed. The light is continuous, and at an elevation of 122 feet above the sea.

The harbour of Frazerburgh is at the foot of Cape Kinnaird. For its repairs, the inhabitants advanced 5620*l.*, and the commissioners of highways in the Highlands, 5620*l.* These funds were applied to the prolongation of the jetty of the harbour, which now projects 146 yards and a half, reckoning from the low-water mark. This work has produced such satisfactory results, that the inhabitants have raised new funds to complete the improvements, which render their harbour one of the best on the eastern coast.

We will now, for a moment, leave this coast, and take a view of the interior of the county of Aberdeen. It extends as far as the Grampian hills. Its higher parts are generally barren. In the lower, we meet with immense tracks of peat grounds, totally unfit for cultivation, but very valuable, nevertheless, on account of the fuel they afford, in regions so far advanced north, which have no more forests, and which are destitute of coal-mines. But in the vicinity of the sea, where the temperature is always mild, even in winter, agriculture is in a high degree of prosperity. It is the same in the numerous valleys, where rivers and torrents, which come down from the mountains, flow. Hence, the valleys are considered of so great importance, that they generally give their names to the districts of which they constitute a part; for instance, the districts of

Strathdon, Strathdee, Strathbogie, are those, the centre of which is occupied by the valley of the Don, the Dee, the Bogie, *&c.*

The county of Banff is bounded towards the east by that of Aberdeen; the Doveran, and the Spey, are the only rivers that water it.

The ports of *Macduff* and *Banff*, of which the whole parish does not contain 4000 inhabitants, are divided only by the mouth of the Doveran; the former needed repairs, which are now in progress: the latter, finished in 1775, had likewise, in more recent times, occasion for extensive improvements; it was very small; a new mole has just been added to it*. In proceeding to the west, we find, at the mouth of a torrent, the port of Cullen, which reckons 1452 inhabitants, chiefly employed in fishing †.

To the west of Cullen, the Spey empties itself into the ocean. It is one of the rivers in the Highlands which extend their course farthest inland; it has its source at a short distance from the western

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* This work was estimated at 14,000*l.* The commissioners for public roads advanced half that sum. The tempest which destroyed a portion of the jetty of Peter-head made a similar breach in the pier at Banff—the damage was repaired for 2000*l.* The end of the jetty is laid upon caissons.

† For the improvement of this harbour, which is much exposed to the north, a jetty of 250 feet has been built; it makes a turn, to shelter the fishing smacks. Rocks which obstructed the landing place have been removed. In 1821, the improvements had cost 4000*l.*, one half of which was defrayed by the commissioners, and the other moiety by Col. Grant, proprietor of the adjoining lands.

maritime coast. Notwithstanding the alluvions which obstruct the mouth of this river, its waters, at high tides, are deep enough to allow vessels of 300 tons burden to anchor in its channel.

At some distance from the sea, on the banks of the Spey, stands the pretty little town of Fochabers. An elegant church, a stone bridge over the river, the park, and the castle of the Duke of Gordon, a fertile country, and hills recently covered with plantations, combine to produce a scene most fascinating, especially if the traveller come from the coast of Aberdeen, by the way of Inverary and Huntley, as he has been obliged to traverse a vast extent of heaths and barren mountains.

County of Moray,—Likewise Elgin, from the capital of the county, and principal town of a parish containing 5,308 inhabitants. Elgin is situated on the Lossie, at the mouth of which stands Lossiemouth, the port of Elgin. Vessels of eighty tons can enter at high water. The county of Moray has, besides, two small ports, Burgh-head, sheltered by the promontory of Burgh-head, the harbour of which has recently undergone great improvements*, and Findhorn, at the mouth of the river of that name, on the

* The trustees of the harbour have expended 6000*l.*, to which the commissioners have added 2000*l.*, out of the funds placed at their disposal. This harbour has a basin and a rectangular dock, the total length of which is equal to 190 yards, and its breadth to fifty yards. It is dry at ebb tide.

bank of a large and safe bay, though difficult of access.

Nairn, the capital of the small county of that name, reckons only 3228 inhabitants; it is situated at the mouth of the Nairn, a river which abounds greatly in salmon.

At the bottom of the sinuosity formed by the gulf of Murray, and on the south side, stands Fort George, erected upon a peninsula, which separates from this gulf the Bay of Inverness and Loch Beauley.

The town and the old fort of Inverness are situated towards the mouth of the Ness *, at the bottom of the bay, whence they derive their name. They are the works of a military colony, sent by Cromwell, to keep the Highlanders in the surrounding country in check. Inverness is the chief town of a parish containing 12,264 inhabitants, and the largest in the Highlands. It possesses a college, a library, and a cabinet of natural philosophy. It is remarkable for its industry, and forms the centre of a mercantile intercourse, which extends its branches to all the parts that we have been describing. The

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* The town, which stands south of the Ness, and its suburb in the north of that river, are united by a bridge of seven arches, the structure of which is remarkable: the arches are strengthened by strong square mouldings, extending from one pier to the other, projecting very much. This bridge, of an ancient construction, is very high in the middle (*en dos d'âne;*) the diameter of the middle arch exceeding by a great deal the diameter of the others.

Caledonian canal will be the source of a great addition to its trade and wealth. [*Vide* Book IV. Chap. 2.]

The county of which Inverness is the capital, extends as far as the Atlantic sea, and is the largest in Scotland; but unfortunately, the greater part of its surface is covered with rugged rocks, barren mountains, peat grounds, and devastating torrents. It is only in the midst of some valleys, particularly towards the east, that agriculture flourishes. Cattle, wool, the skins of wild beasts, salmon, sea-fish, dried or pickled, hemp in the rough state, or spun, constitute all the productions which the inhabitants give in exchange for articles necessary for their wants.

CHAPTER V.

The North-East Highlands.

Under the appellation of the North-East Highlands, we will include those parts of the country which are situated to the north of the Bay of Inverness, and of that chain of mountains, now united by the formation of the Caledonian canal, which follows a rectilineal direction from the German Ocean to the Atlantic. This division comprehends

Counties.	Population.	Square miles.	Pop. per sq. mile.
Ross and Cromarty . .	70,200	2,975	23
Caithness	30,800	697	44
Sutherland	24,300	1,797	14
Orkney and Shetland .	54,200	1,320	41
Inverness and Hebrides .	36,800	4,119	9
Totals	216,300	10,908	26

Of this population we may, without falling into any sensible error, consider one half as belonging to the eastern, and the other half to the western coast.

By crossing Loch-Beauley, or the Bay of Inverness, we enter the county of Ross, which is washed by the western and the eastern seas. The eastern coast of this county presents twelve deep gulfs, which contain a variety of small harbours and

natural roadsteads. Upon the northern shore of the Bay of Inverness, we find the small burgh and harbour of Avoch, the property of Sir George M'Kenzie. In 1815 the masonry-lining of a dry dock was completed.

At the entrance of the bay, opposite to Fort George, stands Fort Rose; their cross-fire defends the gorge. These two forts were erected by George II. after the rebellion of 1745, in order to secure a key to the Highlands. The commissioners of roads have given, not long ago, 4,000*l.* to improve the small harbour opposite Fort Rose*.

On departing from this harbour, we proceed towards the north along the western shore of the gulf of Murray, and arrive at Cromarty, the chief town of a small county, situated at the entrance of a magnificent bay, which bears the name of this town and county. This bay receives the waters of a number of lakes and torrents, is sheltered on all sides, and is at once spacious and deep. Its importance would be felt and appreciated in the event of any northern power engaging in a maritime war with Great Britain.

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* The two strips or tongues of land beyond Fort George and Fort Rose are slightly-inclined beaches, which do not afford much facility for landing. On the Fort Rose side, alone, a jetty (at Channery) is built for the convenience of disembarkation. If the board of ordnance would construct a similar accommodation on the other side, it would be rendering an essential service to that part of the country.

Cromarty contains only 2000 inhabitants; the same number comprises the population of Dingwall, which stands on the inner extremity of the bay, on the banks of the Petter; this river winds through a sort of bog, at a short distance from the last-mentioned town. For improving the course of the Petter, and making a harbour for Dingwall, a canal has lately been excavated, and two quays built, in which vessels drawing nine feet water find a convenient approach.

The bay of Cromarty has several other small ports, in which jetties and landing-places have been built or enlarged, such as Invergordon and Balinghead; they afford great advantages for the export of the produce of the county of Ross, and for the import of coal, and lime for manure, articles of vast local importance.

In resuming our journey along the sea coast to the extremity of the bay which we have just described, we do not find any point worthy of notice, until we come to the promontory called Tarbetness. It terminates a very prominent tongue of land which separates the gulfs or friths of Murray and Dornoch. The latter frith contains the harbours of Mahomac* and Tain, the principal town in a parish

* A pier, 116 yards long, with a turning sixty-eight feet long, has been constructed there. One half the expenses of the work was defrayed by the commissioners, and the other moiety by the Marquis of Stafford, who is in the course of making great improvements in the county of Sutherland, which, by the addition of this jetty, will become more important.

of 2861 inhabitants. Beyond Tain, the gulf, which is exceedingly narrow, penetrates some distance into the country, and receives the waters of a great number of lakes and rivers; its northern coast does not contain any port or maritime station worthy of notice, along the whole coast of Sutherland.

The county of Caithness, the most northerly of Great Britain, possesses some fishing villages scattered along the coast, and the small town of Wick, the chief place in a parish containing 6,713 inhabitants, situated at the mouth of the Wick. The harbour is protected by a jetty. During the fishing season, so great is the resort of boats, that one thousand, with five thousand fishermen on board, have been seen to enter the harbour at the same time.

The Cape farthest advanced towards the north, is called Duncansby. It terminates the western coast of Great Britain.

We have few remarks to make upon the Orkneys and the Shetland Isles, which are situated to the north of Duncansby. These Isles formerly belonged to the Kings of Denmark, who have preserved only Iceland, in the seas to the north of Great Britain.

Shetland and the Orkneys are far from fertile, and have hitherto supplied very few resources for trade. The subjoined is the state of their population:—

Main Land.	*South Isles.*	*North Isles.*	*Shetland Isles.*
15,062	7922	3995	26,145

These Isles do not possess any public works which could serve as a model. They ought to attract the attention of navigators and engineers, only on account of the dangers of their shores. It was not until 1789, that a light-house was built on the Isle of North Ronaldsay, one of the Orkneys; it was afterwards transferred to the Isle of Sanday. In 1794, another light-house was erected upon one of the small Isles called Skerries, in the strait of Pentland, which divides the Orkneys from Great Britain.

BOOK IV.

EASTERN COAST OF SCOTLAND.

CHAPTER I.

General Observations on the Highlands.

In 1745, when the Pretender attempted to recover the throne formerly occupied by his ancestors, it was in the Highlands that he came in quest of partisans and defenders. The chiefs or captains of the clans* had only to raise the standard of revolt, and to sound the military bag-pipes†, to call forth their vassals, who were always ready to fly to arms, on the alarm of an invasion. With these men, inured to hardships, and despising danger, the Pre-

* The clans are distinct tribes, who used to take the field under independent chiefs. The men belonging to the same tribe wore a dress chequered by vivid, particular, and invariable colours, which served as a distinctive mark to the respective clans.

† The bag-pipes are still to the Scotch regiments, what the fife is to our regiments in the South. In battle, the piper plays the favourite airs of the highlanders, and this barbarous music kindles in the breasts of the soldiers all the enthusiasm of the Caledonian heroes of olden times.

tender carried all before him in his progress, and reached, as in triumph, to the very heart of England. His little army, however, after performing prodigies of valour, was defeated; he fled, and left his deluded adherents a prey to the vengeance of the established government.

The first act of power fell upon the feudal system, which kept the highland tribes in a state of ignorance and barbarity. A number of chieftains fell in battle, many sought an asylum in foreign countries, and others died upon the scaffold. The property of these men was confiscated; and the *lairds*, who, more fortunate, escaped the general disaster, lost for ever their political and military influence. The greater part of them ceased to reside among their vassals. Some were returned to parliament, others came to court; nearly all, in adopting the manners of England, imbibed, at the same time, a sort of dislike for their home, and acquired a passion for travelling. In the course of a few years, this emigration produced a complete revolution in the condition of the highlands. The lords, when they resided upon their domains, derived their power and their consequence from the number of men they could lead to the chase in time of peace, and to the field of honour in time of war. Their interest was chiefly promoted by the increase of the population on their estates. To attain that object, they permitted, nay encouraged, the division of their lands into a multiplicity of small allotments, each of

which was sufficient for the subsistence of a family as frugal as numerous*.

When the lords saw their feudal patronage reduced to a mere nullity by the increase of the royal authority; when, disgusted with a residence which no longer had, for them, the attractive charms of absolute power, allured by the seductions of the court, and detained by the pleasures of the capital, they deserted the mountains; they now viewed their feudal possessions only as material capitals, which ought to be managed according to the principles of political economy; that is, with the fewest possible hands, in order to derive from it the greatest possible pecuniary benefit. Vast pasture grounds absorbed the small fields which had sufficed for the maintenance of as many families. The consequence was, that the sons of Caledonia were suddenly bereaved of the land which, for 3000 years, they had cultivated and preserved free, even from the yoke of the Romans!

Such was the terrible scourge of the extreme monopoly of lands for these unfortunate men. Fruitless were the attempts to attract the dispossessed highlanders to the more fertile countries of

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* This division of lands, and the sub-division of lots, were renewed at certain periods among the vassals, without the intervention of the lords. The head of a family would say to his wife on the arrival of the time of distribution,—"Wife, give me my dirk; to-day I am going to the allotment of lands."

England and the lowlands. When an individual loses his paternal roof, and the hope of ever entering it again, he must fly to such a distance that no external object shall recal the recollection of it. The unhappy Scotchmen turned their eyes towards America, and abandoned, in vast numbers, the land of their forefathers*.

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* The depopulation became particularly alarming towards the close of the eighteenth century. From 1800 to 1811, the means employed to promote the prosperity of the coasts of the highlands succeeded in counter-balancing, even with a slight preponderance in its favour, the loss sustained by emigration. From 1811 to 1821, the conversion of arable ground into pasture had produced the most pernicious effects upon the population; at the same time, the improvements in manufactures, commerce, and the fisheries, assisted by great public works, began to diffuse their beneficial influence. The population of the highlands then advanced at a pace less disproportionate with that of the other parts of Great Britain, as will be made obvious by the subjoined table.

Population	1801	1811	1821
Argyll	74,300	88,400	99,300
Caithness	23,400	24,200	30,800
Inverness	76,800	80,900	92,000
Orkneys and Shetland	48,400	47,700	54,200
Perth	130,600	139,600	141,800
Ross and Cromarty	57,200	62,900	70,200
Sutherland	23,900	24,000	24,300
Totals	434,600	467,700	512,600
Rest of Scotland	1,217,800	1,398,200	1,622,700
England	9,168,000	10,502,500	12,218,500

Relative Proportions of the Increase of Population.

Highlands	1000	1076	1096
Rest of Scotland	1000	1148	1160
England	1000	1145	1163

The government, alarmed at this emigration, apprehended, that, if men hardened by the rudest of climates should totally abandon their native country, no inhabitant of the provinces more favoured by nature would go to supply their place, in order to cultivate an ungrateful and disheartening soil; the greatest exertions were accordingly made by government, with an intention of ameliorating the condition of the Scotch highlanders. The government opened numerous and easy commercial roads across the defiles of the mountains, over which, until then, no one, except shepherds and huntsmen, had passed; erected light-houses on the most dangerous approaches on the main land and on the isles; encouraged and gave every facility to the establishment of small trading ports and fishing villages along the sea coast, and on the banks of the principal lakes; and anxiously endeavoured to propagate in those regions the lights of civilization, by founding schools, introducing the Bible, and the knowledge of the English language.*

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* Among the Lairds who continue to reside in the Highlands some of them obstinately oppose the means used to enlighten their vassals, by whom they are still revered and dreaded, through the tradition of a weak and servile obedience. In order to give an idea of this anti-social disposition, I shall adduce only one instance, but it is a striking one, and merits profound reflection.

In following the line of the Caledonian Canal, along the side of Loch Oich, I traversed the valley or glen of Garry. I passed, at first, in front of a mansion situated near the ruins of an old fortified castle, the remains of the power of the M'Donnells over the sur-

We now proceed to offer, on these beneficent works, some details relative to the subject upon which we are treating. We have already made known (see Vol. I.) the system adopted by the British government, to opèn roads in the country which we are describing, by drawing out of the public purse an assistance commensurate with the voluntary contributions of the inhabitants, for the important object of general and local utility; thanks to this enlightened system, the Highlands now possess 900 miles of commercial, and 276 miles of military roads, making a total of 1176 miles.

It may be supposed, that the execution of so vast

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rounding country. Over the porch of the modern edifice I observed hanging, as monuments of triumph, the heads of wild beasts and the carcasses of birds of prey. These were the trophies which the chieftain had gained in his annual hunting excursions, in which he assembles the Highlanders of his clan, together with the visitors of the neighbouring clans, all dressed in their particular costume. They continue the diversion for three days, passing the nights in the forests; the party then return to the castle, to feast upon the produce of the chase, intoxicate themselves with whiskey, and abandon themselves to the excesses of a brutal intemperance, often marked by bloody quarrels and affrays.

At some distance from the seat of the M'Donnells, I observed a monument which made me start back with horror—the subject is this. Upwards of two centuries ago a noble family had, by some acts of injustice, incurred the resentment of its vassals; seven of them joined and murdered that family; at least a concurrence of circumstances pointed them out as the authors of the horrid deed. The Laird, in whose clan the crime was perpetrated, instantly despatched his satellites with this brief and simple order, "Go and bring me the heads of the guilty." They found the wretches in a

a development of highways, through a very mountainous country, intersected by countless rivers and torrents, required the erection of a great number of bridges. The subjoined is a numerical table of them:—

BRIDGES WITH					
1-arch.	2-arches.	3-arches.	4-arches.	5-arches.	7-arches.
1075	14	21	1	5	1
Span in Yards.					
11,152	856	2295	213	1055	487½

Total number of bridges 1117
Total span . . . . 16,058½ yards.

Thus it appears, that from 1803 to 1821, the commissioners, having the care of the public roads in

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cave, where they had taken refuge, and decapitated them; they took the heads of their victims to the fountain in the neighbourhood of Glengarry, for the purpose of washing them, and having made them fit to be presented, (*présentables*), they offered them to the chieftain who had demanded them.

Over this fountain, on the bank of Loch Oich, stands a quadrangular pyramid, the spire of which bears the representation of seven heads, still convulsed, as if struggling in the agonies of death. The heads placed in a circle at the top of the pyramid, show from all parts, their hideous faces, with their hair bristled, and grasped by an enormous hand, holding a sword, from which blood is dropping. Upon the four sides of the pyramid is written, in English, French, Latin, and Gaelic (the idiom of the Highlanders) the inscription which gives an explanation of the monument of the cannibals. When I visited it, a dreadful tempest was raging, and the rain was falling in torrents; I alighted, notwithstanding, from my horse, and took a literal copy of the inscription:—

"In memory of the signal and quick vengeance which directed, according to the rapid course of feudal justice, the commands

the Highlands, have caused to be built 1117 bridges, which give, for the passage for the water, a total width of 16,058½ yards!

On the completion of these vast works, the commissioners gave a general account of them in their ninth report, one of the most important documents that ever was presented to the British Parliament. This report is accompanied by a large map of the Highlands, which describes the course of the waters and the direction of the roads, and by two engravings; one gives the plans and elevations of thirty-seven of the most remarkable bridges, erected under the direction of the commissioners; the other contains the plans of twenty-seven sea-ports, at which they had directed the erection of moles, jetties, quays, docks, and landing piers. *(Vide Plates.)*

In 1745, the government, as we have already ob-

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of Lord Macdonald and Aross, for apprehending the perpetrators of the horrible assassination of the Keppoch family, a branch of the puissant and illustrious clan of which his Lordship was the chief; this monument is erected by Colonel M'Donnell Glengarry, his successor and representative, in the year of the Lord 1812. The heads of the seven murderers were laid at the feet of the noble chieftain, at the castle of Glengarry, having been previously washed in this fountain. Since that event, which happened in the first years of the Sixteenth Century, it has always been designated under the name of FOUNTAIN OF THE HEADS."

May my feeble voice make this infamous monument known to all the extremities of Europe, and may the nations feel and appreciate the distinction between such arbitrary sentences, those prompt and glorious massacres of feudal times, with the constitutional judgments of our independent juries!

served, confiscated the estates of all the Scotch land-owners, who had taken a part in the rebellion. In 1784, after the lapse of thirty-nine years, the residue of those estates was remitted to the heirs of the original possessors; but on conditions, which left in the treasury considerable sums, which continued to be applied to the public works in Scotland.

In 1806, the remaining part of these sums, 50,000*l.*, was placed under the management of the commissioners of highways, bridges, and harbours in the highlands, (46 Geo. III., c. 154, 155, and 156,) for the improvement of the commercial sea-ports. These trustees, anxious to derive the greatest possible benefit from the resources which the government placed at their disposal, used them in granting to companies or private individuals, an assistance equivalent to the sacrifices made by local commercial interests for the improvement of the ports. By these judicious regulations, they doubled their means.

Let us call the attention of our fellow-citizens to the wisdom of these Commissioners; a wisdom which cautiously restrains them from undertaking themselves any important works, and which dictates to them an appeal to the well-understood interest, the generosity, the honour of the inhabitants, thus stimulated, by such liberal grants to local interests, to promote the general prosperity of the country. Let us point out this noble example to

our government; and let us entreat its agents to imitate, in all parts of France, this patriotic appeal to the enlightened exertions of private individuals and private companies, to contribute to the national prosperity, by the undertaking of great public works, for the promotion of commerce and industry.

While parliament turned its attention to improving the roads, bridges, and harbours of the highlands, it endeavoured, at the same time, to open extensive channels of inland navigation. The two grand works of this description, are the canal of Crinan, and more particularly the Caledonian canal. The importance of the latter has induced us to devote a separate chapter to its description.

To these works, let us add the efforts of the commissioners, for encouraging the fisheries in Scotland,—extending and improving the manufacture of cloths, and those branches of agriculture connected therewith; and then an idea may be formed of the efficacy of legislative interference, in favour of a country, which, from its latitude and physical conformation, seemed to be condemned to remain for ever a stranger to the benefit of the works which spring from civilization; while these works tend themselves afterwards to give to civilization its greatest scope.

CHAPTER II.

North-West Highlands.

On leaving Duncansby, to survey the western coast of Scotland, we pass between the mainland and the Isle of Stroma; we double Cape Dunnet, a little more advanced to the north than Duncansby; we then enter the bay of Dunnet, where we find the town of Thurso, built upon the western bank of the river of that name. This town, with its parish, reckons 4,045 inhabitants; it possesses thirty-four vessels, measuring 1821 tons. The land belongs to Sir John Sinclair, a learned agricultural writer, justly esteemed for his statistical works on Scotland.

In advancing towards the south-west, we pass before the small harbour of Sandside. We gain the shores of the county of Sutherland, and double first the bay of Tongue*, narrow and penetrating far inland, and, besides, obstructed at its gorge, by the small and numerous isles of Tongue; 2nd, Loch-Eriboll, another narrow and deep bay; 3rd, the bay of Durness; and, lastly, we reach Cape Wrath,

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* A road of the highlands goes from the burgh of Tongue, to the bay of Dornoch, thus uniting the northern and eastern coasts.

so called, no doubt, as is Cape Tempest, on the south-western point of Africa, on account of the fury of the sea on that dangerous coast.

On leaving this promontory, the coast, which bore to the west, now turns suddenly to the south; it is exceedingly intersected, and crowded with bays and havens. In the bay of Scourie* alone, is a village worthy of being noticed; it is inhabited by fishermen. In this part of the coast, the western course of the streams of the county of Sutherland is short and rapid; the valleys are filled with torrents, and the soil, too circumscribed, affords but few resources to the agriculturist. Such are the causes of the paucity of inhabitants on this coast.

We double, without observing any village on their shores, the bays or lochs Inver, Broom, Greinord, Ew, Gairloch, and Torridon; we then enter an immense gulf formed by the main land on the coast, and by the Isle of Sky on the west.

The *Isle of Sky* contains 8795 inhabitants; it is very long; its shores are very much indented, and afford a vast number of large and deep bays, with several smaller isles, which are like appendages to the principal island. Roads, made by the government, pass from one end of the isle to the other; by their branches, they lead to the small ports of Trot-

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* One of the military roads of the highlands goes from Scourie to the bay of Dornoch in the German ocean.

ternish, Stein, Snizort, Dunvegan, Sconsor, Broadford, Ashick* and Armadale.

To the west of Sky, the Hebrides form an uninterrupted chain, the length of which exceeds 155 miles; they have 17,935 inhabitants. The chief isles are Barra, Benbecula, South and North Uist, Harris, and Lewis, of which Stornaway, the best port, reckons seventy-four vessels, measuring 2906 tons. These isles do not exhibit any public works upon which we can direct the attention of the reader.

In advancing towards the south, we double the lochs or bays of Navish, Morrer, Nagaul, Anougal, Aylort, and Moidart; leaving, on the west, the small isles of Canna, Rum, Eig, and Muck. Two short roads lead from the lochs Nagaul and Moidart, upon the banks of the Caledonian canal; as also the roads which traverse the peninsula of Morvern, and the isle of Mull, which terminate, on the south, the north-west Highlands.

The Isle of Mull, nearly as large as the Isle of Sky, is of a very irregular shape; it forms a part of the county of Argyll, and comprehends 8732 inhabitants. At Tobermory, its chief port, thirty vessels, measuring 712 tons, are registered.

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* From Ashick, the road forks, to bear upon two points near to the main land; the northern branch communicates with the road which crosses Ross-shire, and extends as far as the bay of Cromarty. The southern branch is directed towards the middle of the Caledonian canal, as well as another road which commences at the bottom of the bay of Hourn.

The Isle of Mull is separated from the peninsula of Morvern, by Loch Sunart, and by the sound, or strait of Mull. Like Mull, Morvern and all the land situated between the sea, and Lochs Eil and Ayfort, belong to the county of Argyll.

West of the Isle of Mull are the small isles of Coll, Tirree, and Icolmkill, and that of Staffa, famous for the grandeur and the regularity of its basaltic rocks*.

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* A traveller who understands the duties of his office ought never to write upon Scotland, without presenting the reader with a florid and lengthy description of the romantic beauties of that island. He ought to contrast them with the no less picturesque beauties of the Giant's Causeway, on the coast of Ireland. In a word, if he would soar above the vulgar, he ought to elevate his style by an erudite application of all the Greco-Latin expressions that the copious nomenclature of Wernerius and Linnæus can supply: the writer would thus join, to the erudition of the mineralogist, the display of sentiment, and the graces of chemistry.

CHAPTER III.

Caledonian Canal.

The Caledonian canal has equal claims to the attention of the engineer, the economist, and the statesman, on account of the grandeur and difficulty of the enterprise; the influence of this navigable passage upon the industry, the trade, and agriculture of the adjoining country; and, finally, on account of the commercial revolution produced by the alteration in the course of those ships, which were formerly obliged, at the greatest hazard, to double the Orkneys, in order to pass from the Baltic into the Atlantic ocean, while these ships find now a safer and more direct way to the same destination.

The celebrated James Watt, who commenced his professional career at Glasgow, drew, in 1773, a plan of the central parts of the highlands, agreeably to instructions from the commissioners of the estates, which were confiscated after the rebellion of 1745. Among the expedients which this engineer proposed, for ameliorating the condition of the highlands, were the canal of Crinan and the Caledonian canal.

The highlands of Scotland are divided into two parts, nearly of equal extent, by a series of lakes running in a direct line from the north-east to the south-west. They are called Lochs Ness, Oich, Lochi, Eil, and Lynnhe. The contiguity of these lakes pointed out, at the first glance, the facility of a communication between the two seas which wash the east and west of Scotland. It was sufficient for the accomplishment of this important object, to excavate between the three first lakes and the two seas, twenty-one miles of canal, to obtain a navigable line on an extent of at least 100 miles.

In 1802, the Lords of the Treasury, being anxious to ascertain

with precision, what could possibly be undertaken for the benefit of the highlands, with a view to put a stop to, or at least to diminish the then prevalent emigration, authorized Mr. Thomas Telford to make a new survey of the coast and of the interior of the country. In support of his plans, Mr. Telford presented a voluminous report of the nature of the works which appeared to be the best calculated for the general improvement of the country, and the employment of the inhabitants, who could no longer procure any work. Mr. Telford, in his memorial, renewed the proposition submitted by Watt; namely, to open a canal from Inverness to Fort William; but Watt would only allow a depth of nine feet ten inches to be given to this canal, (which was only two feet more than the then depth of the canal from the Forth to the Clyde, which, from the first, was called the Grand Canal.) Mr. Telford observed, that the upper lakes furnished, at the point of separation, a most abundant supply of water; that the dimensions of the vessels employed by merchants in general were on a much larger scale: he thought, in consequence, that it would be a *desideratum* to open a passage for the large vessels in the Baltic trade, and even for frigates of twenty-eight guns. Under this impression, he proposed to give the canal a depth of twenty feet.

A committee of the House of Commons, appointed to inquire into the state of the highlands, and to devise the most efficacious means of improving their condition, took Mr. Telford's plan into consideration. In order to obtain still more information on the possibility of the enterprise, and the probable expense of carrying it into execution, the committee took, at the same time, the opinion of Mr. Jessop and Mr. Rennie, the two engineers who had, at that time, the highest professional reputation. Naval officers, of great professional experience, were also consulted on points connected with the navigation and anchorage of vessels in the canal and on the lakes; and, lastly, the returns of the arrivals and departures from the ports of Liverpool, Greenock, Leith and Aberdeen, enabled the committee to form a more correct judgment of the advantages which were likely to result from the new

passage offered to the vessels regularly sent from the German ocean to the Atlantic, and *vice versâ*.

The result of the investigation having proved favourable to the project, an act of parliament, passed in July, 1803, granted the funds requisite for its execution. A commission, appointed by the act for directing the works and regulating the expenditure, chose Mr. Thomas Telford as their engineer, and gave him directions; 1st, to take, without delay, a survey of the ground from Inverness to Fort William; 2nd, to excavate the necessary pits, to ascertain the nature of the soil. Mr. Jessop was equally engaged to take a survey, and presented his own estimates of the expense. Thus, a double certainty of the practicability of the enterprise was obtained. At the same time, a skilful hydrographer, Mr. Downie, sounded the depth of the lakes through which the line of navigation was to pass.

The length of the excavations of the canal is twenty-one miles and a half, that of the intermediate lakes, thirty-seven miles and a quarter, which gives a total length of fifty-eight miles and three-quarters. The breadth of the canal at the bottom, is fifty feet. From each side of this flat bottom, proceed sloping banks, whose height is to the horizontal breadth, as two to three. This slope is continued as far as two feet beneath the level of the water; here the bank is horizontal, upon a width of six feet; then, it slopes again with the same degree of inclination as the lower part, and rises above the water. (See plate.)

The object of this break, in the slope of the bank, is to prevent the larger vessels from approaching too close to the sides of the canal, and destroying the embankment in the upper part*.

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* It is independently advantageous to oblige vessels to keep at some distance from the sides. The eddy produced between the vessel and the sides of the canal, is then much less considerable, and does less injury to the banks than when the vessels can approach so as to come in contact.

If, by accident, some portion of the earth should fall from the top of the bank, being stopped by the flat part of the embankment just described, it would not encumber the bottom of the canal; while, at the same time, there would be no difficulty in clearing this flat from the fallen earth, it being only two feet under water. A similar contrivance ought to be adopted in all large canals. The depth of the water, as we have stated, is twenty feet, which gives a breadth of 122 feet at the top, on account of the two slopes and the two flats, as we may see, 50 feet $+$ 20 feet $\times 3 + 6$ feet $\times 2 = 122$ feet.

The differences of the level are compensated by twenty-three locks, to which it was originally intended to give only thirty-eight feet in breadth, 162 in length. In order, however, to admit the passage of thirty-two gun frigates, the width was enlarged to forty feet, and the length extended to 172 feet, the depth remaining the same. The surveys, soundings, and tracing of the canal, were finished in 1804, and the excavations were begun. The eastern part was intrusted to the direction of Mr. John Telford, and the western part was confided to Mr. Davidson, who had conducted the works of the Ellesmere canal.

The entrance of the Caledonian canal is situated at the point of union between Loch-Beauley and the bay of Inverness, and not far from the mouth of the Ness, a large, rapid, and most impetuous river, which rolls the overflowing waters of Loch Ness on a bed of sand and stones. It was found impossible to make this torrent navigable; it was therefore deemed necessary to excavate a parallel canal, commencing at the point just mentioned, and terminating at the northern extremity of the lake.

It was intended, that the canal should open towards the east, in conformity to the general direction of its line; but in order to realize that intention, it would have been necessary to carry the excavations, to a considerable distance, through a bank of sand and loose stones incapable of retaining water. It was thought advisable, therefore, to take a less direct course, by turning a little more to the north, skirting a hill, which is situated between Loch

Beauley and the bay of Inverness, and finally, by terminating the line at a place called Clachnaharry. To open into Lake Beauley, with a competent depth of water, the line of the canal was made to advance 337 yards into the lake, by erecting two embankments, which form an artificial bed for the canal. The masonry work at the head of these embankments, begins at thirty feet under the level of the water at high tide.

The banks of Loch Beauley, formed by alluvions, consist, for more than sixteen yards under the water, of a bluish clay as soft as mud, and which covers a stratum of whitish and more consistent clay, resembling that which composes the base of the neighbouring hill, along which the canal passes. Without making any excavations, they threw on the loose bottom of the lock, and according to the intended direction of the banks of the canal; 1st, clay procured from the hill just mentioned; 2nd, broken stones and chippings: this mass, by its own weight, sunk eleven feet in a short time. They had also recourse to the same method, to consolidate the soil upon which the sea-lock was to be built, which seemed more economical, and to offer more solidity than founding upon piles; this artificial soil, having been thus prepared and carried higher than it was intended to remain, they began to excavate it to lay the foundation of the entrance lock. It had become so compact, in consequence of its settling and binding together, that these excavations were carried to a great depth, before the filtrations were sufficiently considerable to render the use of draining-machines necessary. The piles were easily driven in this artificial soil; but, such was its tenacity, that soon after it was impossible to draw them up again, or to drive them deeper.

The foundations being thus prepared, they laid, according to the longitudinal axis of the lock, a course of hewn stone two feet in thickness to support the key of the inverted arch, which was to extend from one side of the lock to the other. The masonry becomes thicker as it recedes from the middle; it is nine feet ten inches in vertical thickness, at the spring of the lateral walls. These walls were built with the greatest possible rapidity, in parts

eighteen feet in length, which were carried to the height of the apron of the lock-gates, (that is about eight feet.) The inverted arch was afterwards executed; both this arch and the external surface of the lateral walls were protected by a strong casing of hewn stone. Mr. Davidson displayed much professional talent and perseverance in surmounting the difficulties of this part of the work.

A second lock, at a short distance from the first, keeps the water in the upper part of the canal eight feet and a half above the intermediate waters, which are themselves kept, by the entrance-lock, seven feet and a half above the mean level of the sea. Between the second and third locks, we find a capacious basin, having nearly the figure of a segment of a circle; it is a sort of resting place for the ships arriving from sea, and for those that are preparing to depart from the canal. The distance from Inverness to this basin, is only 1640 yards.

In pursuing the line of the canal we cross, in passing under a swing-bridge*, the high road from Inverness to Beauley. We rise immediately afterwards by four locks, each of which retains the

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* These bridges combine elegance with lightness, (*vide* plate of swing bridges.) Five ribs of cast-iron, thin but wide, and open to be less bulky, are joined together by bolts and traverses; they bear a wooden platform, upon the middle part of which carriages pass, and the foot-passengers on the sides where a foot-path is left for them. A large arc of a circle, in cast-iron, with cogs, is firmly fixed in the masonry, in such a manner, that its centre is upon the axis of the moveable part of the bridge. Upon one side of this moveable part, is fixed a vertical pivot, bearing at the lower end a cogged wheel which catches in the large cogged arc; while the top of the pivot carries a hollow cap, containing a set of wheels, which transmit the rotary movement of a winch to the vertical pivot, which pivot causes the bridge to open and shut by means of the cogged wheel catching in the large stationary. This manœuvre is executed by men stationed upon the bridge, and not, as is usual, upon the shore.

water at a height of eight feet. These locks being contiguous, the same masonry-work is, at once, the head of one lock, and the tail of the preceding one. By these means, five gates are sufficient; the first and last are of English oak, and are like those of the London docks. The three others, being less exposed to violent concussions, have their frame-work of cast-iron, planked over.

It was originally intended that all the gates of the Caledonian canal should be made of wood; but when the moment arrived for constructing them, the country was at the height of the late war. The timber which must have been devoted to that work, was invaluable for the construction of men-of-war. The royal navy required all the oak timber of large dimensions that England could supply. Scotland had long been stripped of her forests, and the continent, by our immediate power or political influence, was shut to the English. Thus, necessity was the promoter of the progress of art, and wood was superseded by iron.

The experiment of substituting iron for wood had been previously made for the gates of a small dock, built upon the bank of the river Carron, for the purpose of repairing the vessels in the service of the famous foundry of that name; but that which appeared easy, and to use the expression, elementary, when working upon small dimensions, presented much greater difficulties when they had to execute the frame-work of gates which were to sustain a pressure equal to a weight of 225 tons.

The plates represent these gates*. The average expense of

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* To form the hanging-posts which are the principal parts of these gates, they have cast, all of one piece, hollow cylinders of iron, having twenty-six feet in height, and about one foot eight inches in diameter: the base has the figure of a D, and is composed of a semi-circle, of which the diameter has been drawn a little further back from the centre, in a parallel direction, in order to give it more superficies, by prolonging the two extremities of the semi-circle with two tangents.

A solid

each lock of the canal, is about 8000*l*. The masonry is executed according to the forms, and agreeable to the principles, which we have explained in treating of the London docks. (See Plates.)

From the four locks at Muirton to the entrance of the canal into Loch Ness, the distance is nearly five miles. In this extent the soil is almost wholly composed of sand and pebbles. It, there-

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A solid hemispherical die, of cast-iron, fitted tightly in the lower end of the post, turns into a metallic socket, strongly imbedded in the masonry-work of the apron of the gate.

A cylindrical head, the contour of which is circular, fixes on the upper end of the post. It is girded by a flat collar of iron, which is made tighter or looser by means of screw-bolts, and the ends of which, being prolonged by flat bands of iron, are firmly set in the upper part of the masonry of the lock gate. The horizontal beams of the gates have been replaced by iron pieces, the profile of which has the form of a ⊣. Against the horizontal branch of this ⊣ are fixed, with screw-bolts, planks vertically laid, and close to one another. Every one of the cross-bars or beams are screwed up; at one end, against the flat part of the hanging post; at the other, against the other vertical piece of cast-iron, which forms the head of the gate, and which completes its metallic frame. A plank, cut wedge-like, is laid all along the exterior surface of this last piece or head. When the gates are locked, the two faces of these planks press one against another. This wood lining was necessary to prevent the collision of iron against iron. Perfection in the structure of iron lock gates was not attained at once. The first that were made were very massive—they weighed nearly twenty-eight tons, while those now in use do not exceed twenty-two tons. To effect this great reduction in the weight and expense, instead of making the hanging-post full on all its sides, the flat side to which the horizontal beams are screwed, was made open, so that at present that side exhibits as many rectangular open spaces, as there are intervals between the different bars. It is, by these means, easy to pass the screws from the interior of the post through the end of the cross-beams or bars; whereas, formerly, it was necessary to make an apprentice go inside the post (like a sweep in the funnel of a chimney,) to introduce the screws into their respective holes.

fore, became necessary to cover the sides and the bottom of the canal with a thick coat of beaten clay, to prevent the waste of water by filtration. In two places the Ness washes the foot of two hills, which are very steep, on account of the waters of the river having undermined them. Instead of cutting through these hills, to open, at a great expense, a bed for the canal, it was thought preferable to turn the course of the river itself, and convert its old channel into a bed for the canal.

On the side of Loch Ness, the canal is closed by two locks, about 875 yards distant from each other; that which is immediately opposed to the waters of the lake, and which serves as a regulator to the water of the canal, is founded upon a very bad soil, and quite close to the place where the Ness begins, a circumstance which rendered its construction exceedingly difficult. This lock recovers a fall of six feet six inches.

Loch Ness, at its eastern part, where we have arrived, becomes contracted, and, at the passage of Bona, resembles the neck of a bottle. Before entering it we find Loch Doughfour, one mile long and from 280 to 350 yards broad. This lock forms a basin, as it were, which may be considered as a safe anchorage, when boisterous and contrary winds will not permit vessels to pass through Loch Ness; and, for this lake, it is as a pit, in which the floods, from rain and melting of the snow, deposit a great portion of the mud which they bring along with them. On this account Loch Doughfour is shallow, and required to be deepened about ten feet, in the direction of the canal. The work was done by a ballast boat*.

In order to obtain ten feet more of depth, it is intended to

* The apparatus of this boat, the most perfect I ever saw, is the work of Mr. Hughes. In twelve months it drew up 90,000 tons of gravel. When they found, in the lake, trees and pieces of rock buried in the mud, or gravel, the buckets of the machine were replaced by pick-axes and iron hooks.

make a weir at the entrance of the river Ness; this measure will have the advantageous effect of holding up the waters of Loch Doughfour to the level of Loch Ness; it will naturally tend likewise to reduce the rapidity with which the waters of the great lake pass into the smaller one, at the passage of Bona. This stream is naturally so strong, that it would almost be impossible for vessels to sail against it.

Loch Ness is twenty-two miles in length. On so great an extent, its width does not vary more than from three-quarters of a mile to one mile and a quarter; its depth is as much as 130 fathoms. Its banks under the water have a very rapid slope, so much so, that at a short distance from the shore we find a depth of water of from sixty-five to eighty-two fathoms; we must, however, except the bays of Urquhart, Invermorrison, Cherry Island, and the eastern extremity of Loch Ness. In these places even the depth of the water varies from twelve to twenty-six fathoms. On finding, close to the bank, so great a depth of water, it was thought necessary to put down buoys, on which vessels might be moored, without being obliged to cast anchor, which it would afterwards be found exceedingly difficult to haul up, on account of the extreme tenacity of the soil at the bottom. Independently of this inconvenience, if the wind blew towards the land, vessels would not find room enough to veer away their cable to steady themselves.

When the advantages and disadvantages of the canal were under discussion, one of the principal difficulties was to ascertain to what extent a vast body of water, like that of Loch Ness, pent up between two lofty mountains, could, with safety, be navigable. The opponents to the canal objected that the winds, whatever their general direction in the surrounding country might be, when they pass over the long and deep valley of the lake, change their direction to follow the axis of that valley, so that vessels sailing in one direction would ever have the wind right an end, while vessels proceeding in the opposite direction would have it right aft. The objectors likewise considered it extremely dangerous for a large

ship to tack, or even merely to sail, with a side wind, in a sort of channel, the bottom of which is, near the shores, encumbered with trunks of trees, and rocks; in a channel, which, at a short distance from these dangers, has a very great depth; whilst the collateral vales, which open on the principal valley, give a passage to sudden squalls, which would drive the vessels with violence upon the opposite shore.

Those objections, it must be allowed, had great weight, but they were exaggerated. It was not correct to affirm, that from one end of Loch Ness to the other, a secure anchorage was not to be found. We shall content ourselves with mentioning Urquhart, about one third of the passage, on the east side. There are others on the western side.

To prove the fallacy of the assertion, that the winds always blow upon the lake in a longitudinal direction, meteorological observations, from 1804 to the present time, have been made, at the two ends, and at the centre of the Caledonian Canal; and it has been ascertained that the direction of the winds is as variable in the valley which it traverses, as in any other part of the Highlands.

If, at particular seasons of the year, vessels could not, or durst not, set sail against the wind, they might with safety be taken in tow by the steam-boats. To give an idea of the advantage of this mode of proceeding, let us suppose a vessel having the same draft of water with the steam-boat, and which, for the same celerity, meets with the same resistance on the part of the fluid; in this hypothesis, the celerity of the steam-boat being, as well as the impelling power, represented by the unity, this power, applied to the two vessels, will not produce simply a celerity equal to one-half, or five-tenths, but a celerity equal at least to seven-tenths. Thus the steam-boat, in towing a vessel, will not suffer a diminution of three-tenths of its celerity*.

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* This was written in 1817. Experience now confirms the opinion I then entertained. The towing of vessels is practised with great effect upon the lakes through which the canal passes.

Works of the Central District.

These works begin towards Fort Augustus *, and extend from Loch Ness to Loch Oich. When I visited that district, the entrance lock near the fort was being constructed; the soil, formed entirely of loose pebbles intermixed with sand, was extremely unfavourable, so that when they were excavating, the water, filtering through the gravel, burst in numerous spouts. Notwithstanding this inconvenience it was necessary to dig seventeen feet below the bed of the neighbouring river, by which the waters of lake Oich are conveyed to Loch Ness †.

In order to render the draining easier, it was thought proper to evcavate, to its full extent, the space destined for the site of the entrance lock. The foundation of the lock-gate, nearest to Loch Ness, was the first thing begun—the pebbles at the bottom were covered with a bed of moss, upon which the courses of the foundation were laid, all the lower joints being filled up with the same

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* The sole object of this fort was to keep the Highlanders in check; and it fulfilled its purpose. As it is no longer necessary, we shall some day see those strong built barracks and spacious magazines converted into some flourishing manufactory, which will employ the increasing population, and diffuse through the surrounding country prosperity, instead of terror.

† The draining of water was effected by three steam-engines by Watt: the first a thirty-six horse power, and each of the others of the power of twenty horses; so that the aggregate power applied to this purpose equalled that of seventy-six horses, working day and night. The piles used for the foundation of two locks are of two kinds; those which support the lateral walls are round and shod at the lower end with a cone of cast iron; the others, which form a row under and beyond the apron, are likewise provided with a cast-iron shoe, terminating in a quadrangular point, and broader at its base than its sharp edge is long. These piles were driven by a monkey weighing 200lbs. and worked by nine men.

substance. The effect of the filtrations is to force this moss upwards between the joints; thus a sort of natural caulking is effected in the masonry work, which powerfully opposes the passage of the water.

In the vicinity of Fort Augustus a series of four locks have been erected, each of which keeps the water eight feet high. *(Vide Plate.)* At Callachie, two miles further, a fifth lock is built upon a rock, the size of which is no larger than the foundation of the lock absolutely required. This rock is the only mass of stones to be found in this part of the valley.

From Fort Augustus to the entrance of Loch Oich, the canal is entirely excavated by manual labour, on an extent of eleven miles and three-quarters. I paid particular attention to the economical mode with which the earth was removed.

Total height, from the sea to the highest summit of the canal, ninety-four feet—to Loch Ness, the rise being fifty-four feet, they had only to rise forty feet more, which require five locks, the last of which regulates the water of Loch Oich.

This lake, as well as Loch Doughfour, is too much encumbered by alluvions, not to have rendered it necessary to excavate it in the direction of the canal. This work was performed by a ballast machine.

The bed of the canal is so close to the river Oich, which falls into Loch Ness, that it was necessary to alter, in two or three different points, the course of this river, as well as that of the River Ness; but it was much more difficult to conquer this latter river than the former. In fact, Loch Ness, owing to its immense extent, never has any sudden or great rise, whilst Loch Oich and Garry, whose waters the river Oich discharges into Loch Ness, having a very contracted superficies, in proportion to the expansion of the mountains and valleys, of which they receive the torrents, experience very great variations in their level. The excavations between Lakes Oich and Lochi, do not exhibit any thing that requires particular notice. We now arrive at the last part of the canal,

which extends from Loch Oich, to the Bay of Eil—this bay communicates with the Atlantic, through Loch Lynnhe.

In the same manner, that it was necessary to raise the level of the Loch Doughfour, in the east of the canal, so was it requisite to raise that of Loch Lochi, in the west. But the latter enterprise was much more difficult than the former, for the water was to be raised twelve feet instead of six. It was judged preferable to condemn the old bed of the River Lochi, after digging a new one for it, rather than excavating the lake, to give it a competent depth, an operation which, besides, must have been repeated from time to time, at a great expense.

The new bed of the Lochi extends to the Spean, which falls into the Bay of Eil. The waters of these rapid rivers, after forming a junction, dash in several places against the base of the embankments of the canal; to preserve them from destruction, they have been in some places guarded by a lining in masonry.

From Loch Lochi to the Bay of Eil, the canal follows the foot of the declivity of a chain of hills, whence impetuous torrents rush into the valleys. To give an issue to those streams, aqueducts were constructed for the passage of the canal; several of these aqueducts are formed in such a manner that the waters flow through the central arch, while the two small side arches are reserved for the accommodation of the public. This mode has been found more economical than to build bridges over the canal, in the direction of the cross roads.

The lock which regulates the water of the canal (proceeding from Loch Lochi) has one peculiarity worthy of notice. Instead of using hewn stones in the circular space in which the hanging post of each gate moves, thick plates of cast iron are set in masonry—this application of cast iron, though it may have answered in this instance, has not been productive of any particular advantage, to bring it into general use.

The water of only one torrent is allowed to run into the canal, but before this stream reaches it, it discharges its water into a vast

reservoir, where losing in rapidity, it deposits, besides, the substances which it held in suspension; it is therefore only the highest part of the water, and the clearest, which falls into the canal. Near to this place is an overfall of the superabundant water of the canal. The component parts are of cast iron: the sluices of this overfall and their frames are fixed in the masonry, and the bars, cog-wheels, and winches used for working them, are all of cast iron. The execution of this work is perfect.

Nearly at the extremity of the canal, towards the Bay of Eil, which terminates in the Atlantic, we find the grand chain of eight locks, to which the navigators have given the name of Neptune's stairs. The gates* of these locks have their frames of iron, and the masonry of the locks is worthy of this noble construction. I have attempted to describe the grandeur of this work, in some verses contained in a letter intended to celebrate the *chefs d'œuvre* of the industry of a country which I have visited. The illustrious Walter Scott has not disdained to write an imitation of them which makes us forget the original.

Far in the desart Scottish bounds I saw,
Art's proudest triumph over nature's law;
Where, distant shores and oceans to combine.
His daring hand has traced a liquid line,
Uniting lakes, around whose verges rise
Mountains which hide their heads in misty skies;
Each bound within such adamantine chain,
For ages lash d its lonely shores in vain,
Till, through their barriers, skill and labour led
The willing waves along a level bed.

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* These gates have an opening of forty feet, and retain a height of water equal to twenty. The length of the locks, from one gate to the other, is 180 feet. Finally, the difference of the level of the water, from the upper to the lower is equal to sixty-four feet; which makes eight feet per lock; an inverted arch forms the foundation of each lock.

Thus, e'en within her wildest fastness, man
Subdued his step-dame Nature's churlish plan;
The barren wilds, divested of their shade,
No trees could yield, the giant work to aid.
To mould the gates the skilful artist hied,
And iron frames the want of oak supplied;
Form'd of such stern materials, portals nine,
In basins eight, the sever'd waves confine,
Lockiug each portion in its separate cell,
Whose gloomy grots might seem the gates of hell.
But better-augured name the passage bears,
Call'd by the hardy pilot *Neptune's Stairs.*
There might the sea-god and his vassals meet,
And gratulate the fair descending fleet,
When down those wat'ry stairs were seen to glide
Eight gallant sail that sought th' Atlantic tide.
Commerce and Art the floating wonder hail'd,
Aud triumph'd where the Roman arms had fail'd.

At some distance below Neptune's Stairs, we find, 1st, two locks—2nd, a basin 250 yards in length, and ninety-five in breadth; 3dly, the sea-lock in the bay of Eil, which conducts to the Atlantic Sea.

Several accessory works are yet necessary to give the canal all the advantages of which it is susceptible. Two light-houses ought to be built, the one on Cape Tarbot, at the entrance of the gulf of Murray, the other towards the western entrance between the isles of Mull and Kerrera. A branch canal ought also to be excavated between lakes Eil, Shiel, and the sea. Vessels could then, on quitting the Caledonian Canal, proceed at pleasure towards the south-west or the north-west, by passing along the actual line, or steering through the new cut.

In finishing the description of the Caledonian Canal, which I published in the "*Mémoires sur la Marine et les Ponts-et-chaussées de France et d'Angleterre*," I added, "As to the difficulties which the navigation of some lakes may present, they are real no doubt, yet they appear to me to be exaggerated; at all events

they appear to be much less than the danger of doubling the Orkneys during the tempestuous season. The sailors of the British navy, as well as those employed in the trade shipping are enterprising, active, and gifted with extreme perseverance; I am convinced that they will devise means of surmounting the apprehended obstacles, as they encounter them." Experience has fully justified these assertions, and the navigation of the lakes is not attended with any difficulties capable of exciting apprehension.

The solemn opening of the canal took place on the 23d of October, 1822; a steam-boat and two sloops of war passed from the locks at Muirton, near Inverness, to Fort William. The passage from sea to sea, a distance of sixty-nine miles, was effected in thirteen hours, including the time requisite for clearing twenty-two locks.

CHAPTER IV.

The South-West Highlands.

To the south of the Caledonian Canal, the highlands comprehend a part of the counties of Inverness * and Argyll, and the whole county of Bute. The subjoined are the returns of population for the two last-mentioned counties:—

Counties.	Inhabitants.	Square Miles.	Population per sq. mile.
Argyll	99,300	3,188	31
Bute	14,100	165	85
Total . . .	113,400	3,353	58

The county of Inverness is separated from Argyllshire by the torrent that runs through the valley or glen of Cöe. A road verges on the south bank of the Caledonian Canal, ascends the valley, passes amid

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* The only part of the county of Inverness situated in this new division of territory, includes, 1st, the valley of Spean, which discharges the waters of Loch Loggan into Loch Lochi; 2d, Fort William, at the foot of Ben Nevis, and near to the western extremity of the Caledonian Canal. This track of land is, we admit, compensated by the small portion of the county of Argyll, on the north of the line of the canal.

the mountains which bound the counties of Perth and Argyll, and descends the valley that leads to Loch Lomond, whose waters are discharged into the Clyde at Dumbarton. Let us give a brief description of the sea-coast lying west of the direct road, which we have just traced.

On departing from the Caledonian Canal, to proceed towards the south-west, we clear the pass of Coran; we leave, to the left, Loch Leven, which receives the waters of the torrent of Glencöe. We find near the shore several small islands, the chief of which is Lismore: we leave that island and Kerrera to the east, by following a strait which a cape of the isle of Mull bounds on the west. Behind Lismore and Kerrera, the coast of the main land presents to us the small port of Oban, which owns thirty-three vessels, measuring 1077 tons: it is situated between two narrow and deep bays; the largest, which lies south, receives the waters of Loch Awe.

In continuing to coast towards the south-west, we have, on our right, a cluster of small isles, separated only by a long and confined channel, called the Sound of Islay. The two principal isles, including that of Colonsay, contain 16,993 inhabitants. The Strait, or Sound of Jura is a very large and deep gulf, extending along the western coast of a tongue of land, about sixty miles in length, very narrow, and lying north and south; this tongue

of land is artificially separated from the rest of the county of Argyll, by the canal of Crinan*, and is nearly divided into two equal parts by Loch Tarbert. The isthmus is occupied by the small town and port of Tarbert; the tongue of land situated to the south of the isthmus is called Cantyre; at its extreme southern point is the Cape or Mull of Cantyre; it

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* This canal is essentially connected with the system of navigation of which the Caledonian Canal forms the principal basis. Though this cut is only nine miles long, it enables vessels to avoid a circuitous and dangerous route, to the south and west of the Isle of Arran, and of the peninsula of Cantyre, in proceeding from the Clyde to gain, by the north, the eastern shore of Great Britain. Mr. J. Watt, we understand, proposed, in conformity to a survey of that part of the country, taken by order of the trustees of British fisheries, to open both these passages at the same time.

The coasters from Liverpool and Ireland, who navigate the shores of Scotland, instead of standing off the coast in the Atlantic, always prefer passing, in bad weather, between Great Britain and the peninsula of Cantyre, in order to reach by a sheltered passage the extremity of Loch Fine, and to come out by the canal of Crinan. This canal, however, is not so deep as it was intended to be: it never was a lucrative concern to the projectors, and on this account it was that they lately proposed to give it up to government. It appears to me that the opening of the Caledonian Canal will greatly improve the value of the former. A regular communication by steam-boats, which pass along these two canals, has been established between Inverness and Glasgow. The canal of Crinan was to receive vessels drawing thirteen feet nine inches; it has not hitherto been navigable to vessels exceeding a draught of six feet ten inches; the culminating point is sixty-two feet above the sea; the double fall is surmounted by fifteen locks, each ninety-six feet long and twenty-four wide.

is the point of land nearest to Ireland, whence it is distant only about thirty-one miles. Here begins the strait which the English call the North Channel.

In steering towards the north, we leave on the coast the peninsula of Cantyre, the inhabitants of which amount to 20,668. We next pass by the small bay of Campbelton, the chief town of Cantyre; it reckons a population of 6445 souls, and sixty-five vessels measuring 2663 tons.

Continuing to sail along the coast of the peninsula, we pass through the strait of Kilbrannan, bounded on the east by the Isle of Arran, and, next, enter Loch Fine, which is more than forty-five miles in length.

At the extremity of this lake, and on the principal road from Fort William to Dumbarton, the town of Inverary is situated.

The county of Bute comprehends the isles of Bute and Arran, which are situated at the entrance of the gulfs of Fine and Clyde. Rothsay, the chief town in the county, has a population of 4107 souls, and 101 vessels, measuring 4,601 tons. South of the Isle of Arran, is seen the rock of Plada, upon which a light-house is built, for the guidance of vessels entering the gulf, or Forth of the Clyde. To the north of the Isle of Bute, the district, included between Loch Fine and the Clyde, is very mountainous, narrow, and indented by numerous and very deep bays. The inspection of a good map will make them better known than a long description.

CHAPTER V.

Basin of the Clyde, Glasgow.

The Basin of the Clyde comprehends four counties, under the jurisdiction of the same superior tribunals.

Counties.	Inhabitants.	Square miles.	Pop. per sq. mile.
Dumbarton	27,900	259	107
Renfrew	114,400	227	504
Lanark	249,300	945	264
Ayr	129,800	1,122	115
Totals	521,400	2,553	248

The County of Dumbarton is bounded, on the north and the west, by the county of Argyll, on the east by Stirlingshire, and on the south by the Clyde, which separates it from the county of Renfrew.

The superabundant waters of Loch Lomond are discharged into the Clyde by the short river Leven; at the confluence of this river stands Dumbarton, which contains 3482 inhabitants, who are now extensively employed in manufactures *. At the acute

* When the merchants of Glasgow found it necessary, on account of the distance of their town from the sea, to create a port as a sort of depôt, towards the mouth of the Clyde, they proposed to make choice of Dumbarton. Will it be believed that the inhabitants of Dumbarton rejected a proposal which held out the means of increasing their trade and prosperity? But the fact is so; the gentlemen free-burgesses of the town calculated in their wisdom, that a

angle of this confluence is an old fortress, erected upon a steep rock.

In ascending the right bank of the Clyde, at five or six miles from Dumbarton, we reach the mouth of a canal which merits our attention.

Canal of the Forth and Clyde.

In the line of this canal, a series of defiles not much elevated, and valleys, separate the highlands from the lowlands of Scotland. The Romans seized this singular situation, in order to convert it into a line of defence against the Caledonians. Under the reign of Antoninus Pius, they built a wall flanked with towers, from the Forth, at the mouth of the Carron, as far as the Clyde. The same military position, which served, in the third century, only to detach and save from destruction the frontiers of an empire, already approaching to its dissolution, was again fixed upon in the eighteenth century, as a site upon which to establish a powerful medium of intercourse, commerce, and manufactures.

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numerous shipping never failed to raise the price of provisions; that there is always a dirty appearance in a sea-port town; and finally, that people engaged in mercantile pursuits discover an activity and bustle incompatible with the absolute repose of the good inhabitants; they resolved in consequence to reject the overture. It was, notwithstanding, in the middle of the eighteenth century that the offer was made. This is one of the rare instances in which the Scotch have decided wrong upon an important point connected with their municipal interests.

In 1768, an act of parliament authorized the enterprise of the canal of the Forth and Clyde, with a branch to Glasgow. The works were begun without delay, under the direction of Mr. Smeaton, and after the plans of a Mr. Kell, approved by Mr. Brindley*. Money was frequently wanted, and the canal was not entirely finished until 1790, under the direction of Mr. Whitworth. It was, however, navigable in 1777, from the Forth to Mount Hamilton, near Glasgow. It cost 500,000*l.* The following are the progressive returns of this canal, which, in 1800, yielded a dividend of ten per cent., fifteen in 1814, twenty in 1815, and twenty-five in 1816:—

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* At the period at which the works of the canal of the Forth and Clyde were commenced, the lowlands of Scotland were very remote from the degree of opulence to which they have arrived in our time. The shareholders not being able to complete their number, they resorted to the expedient of increasing the amount of the shares. In 1778, the works not being completed, and the supplementary funds exhausted, it became necessary to open a new loan, which could not be filled. Government then came forward in favour of an undertaking, which could not fail to turn out to the advantage of the finest part of Scotland; government advanced 50,000*l.*, securing to itself a portion of the dividends upon the same footing with common subscribers. With this contribution, and a private loan of 20,000*l.*, the works were completed in 1790. As soon as the intercourse between the two seas by the Forth and the Clyde was completely established, the revenue of the canal doubled in value. In the course of a few years, the company were able to repay, from their own returns, the 70,000*l.* which they had borrowed.

Years	1780	1790	1800	1810	1814
Revenue	5400	8300	21,600	40,600	48,000*l.* sterling.

I travelled over the canal of the Forth and Clyde with the trustees of this valuable property. The celebrated J. Watt still lived; he happened to be at Glasgow, the place of his nativity, and we made this interesting excursion together. I listened to, and contemplated, with a respect mixed with admiration, this venerable gentleman, eighty-three years of age, who, retaining the vigour of his mind, as well as his physical strength, communicated to us a variety of ingenious observations, profound reflections, and important facts, relating to British industry and manufacture, of which he, more than any other individual, accelerated the march during the long period of sixty years. Since 1817, when I visited Scotland, the united kingdoms have lost that great artist, and I have to deplore his death with that of J. Rennie, Joseph Banks, and W. Mudge. In less than five years, all four have descended into the tomb; but they still live in the hearts of their friends, and their services will endure in the memory of posterity.

The canal had originally a height of water of only six feet ten inches; it now has eight feet nine inches, and it is intended to increase this depth to nine feet ten inches: its breadth at the surface of the water, is equal to fifty-six feet; twenty-seven at bottom. Locks, seventy-four feet long, twenty feet four wide, between the gates, for barges twenty feet wide.

At Bowling Bay, upon the Clyde, a little below Glasgow, the lower branch of the canal begins. On a length of eight miles and three-quarters, it rises 156 feet by nineteen locks. At this distance, there is a branch two miles and three-quarters, which extends to Port Dundas, the suburbs of Glasgow.

This branch is upon the same level with the summit level*, the length of which exceeds eighteen miles. Beyond this branch, we descend by twenty locks, on an extent of ten miles and a quarter, as far as Grangemouth, upon the Carron †, quite close to the mouth of that river in the Forth.

The canal has required the execution of several works of art, which are worthy of notice. Eight reservoirs, the total superficies of which amount to 720 acres, have been formed for supplying the canal with water; they are sufficient to fill the locks 25,000 times. Thirty-three draw-bridges, as also ten large and thirty-three small aqueducts have been constructed ‡.

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* From the summit level, there is, on the side of the Forth, a descent of 165 feet. The fall is only 156 feet on the side of the Clyde, where the mouth of the canal is much farther from the high tide way. Thus, the spring tides which rise nine feet at Glasgow, rise seventeen feet eight-twelfths at Grangemouth, on the banks of the gulf of Forth.

† It is this river which gives its name to the most celebrated foundry in Scotland. The Carron company have a branch canal, basins and iron railways, for the arrival of unwrought produce, and the departure of manufactured articles.

‡ The most considerable of all has four arches thrown across the Kelvin, and built of stone. It is seventy feet in height, upon a length of 400 feet; its two sides are furnished with a towing-path. The vertical lining of the aqueduct is in the shape of a concave cylinder; in a line perpendicular to each arch, the supports of the piles are formed by the intersection of the parts projecting from these cylinders, an arrangement which combines economy with stability.

The summit level was attended with singular difficulties in its execution. It passes through marshes; the mud of which their soil is composed, without consistence, is not less than forty feet in depth in some places. In that part of the canal, the banks were continually sinking; they often fell in from the lateral pressure, until the water was introduced into the excavated bed, and formed an equilibrium against the pressure of the adjoining ground.

The passage of the barges through the locks*, and their progress upon the canal, are not less remarkable for their celerity, than the structure of the locks† is on account of its lightness. Besides the team of horses which draw the passage-boats, at a sharp trot, a postilion, mounted on a pony, takes the lead, at the passage of every lock and draw-bridge, alights, assists in opening the gates and raising of bridges; the instant he has done, he remounts and sets off again at a gallop. The manœuvre in the boat is equally worthy of attention, as well as the mode‡ of disengaging

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* In two minutes a lock is emptied. To prevent any dangerous shock against the gates, the vessel is furnished with ropes, having an iron ring at the end, which is fixed easily to iron hooks secured in the walls of the lock. To open and shut the sluices above and below, one of them is served by the keeper, and the other by one of the navigators of the passing vessel. Three minutes suffice for the entrance and exit of the boat.

† They are commonly of larch, the only sort of timber which is to be found in abundance in certain parts of the highlands. Each gate has its sluice secured by a rack or rod of iron indented towards the top, and catching into a pinion which is made to act by means of an iron lever; a catch prevents the sluice from falling, while the keeper is withdrawing the lever from one hole of the axis of the pinion, to fix it in the upper one, as is done in working a capstan.

‡ It frequently happens, that there is occasion to unfix the rope used for drawing the boat; particularly at the passage of a bridge or a lock, or when meeting with other boats, *&c.* This rope terminates, at the end fastened on the vessel, in a plain ring,

the tow-rope. In winter the ice is broken, to prevent any interruption in the voyages of the boats *.

In a commercial country, the rapidity of conveyance is an object of the highest importance; it greatly promotes the activity, the increase of business, and the extension of commerce—for instance, by the means employed to accelerate the passages upon the canal of the Forth and Clyde, a person can go from Glasgow to the Forth in five hours; five more are sufficient to enable him to reach Edinburgh by the stage coach. In 1812, the number of passengers who took this rapid and economical route were 40,000; in 1813, it increased to 64,000; in 1814, to 75,000; and in 1815, to 95,000. Since that period, the number has become still more considerable, and the produce of the canal has augmented in proportion. Such an instance of growing prosperity ought to fix the attention of our proprietors of hydraulic conveyances.

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which is passed upon a vertical thole towards the forepart of the boat; there is one on each side. The thole is thicker at the top than at the bottom, to prevent the tow-rope from slipping when it is vertical; it can be laid down flat, as occasion may require, around a horizontal axle, by pressing with the foot upon a pedal which depresses a spring. At the instant the navigator in front of the boat wishes to disengage the tow-rope, he presses upon the spring. By the tension which the tow-rope suffers, it lays down the thole, from which it is disengaged in a moment. This apparatus is very simple, and we might use it to advantage on board of all our passage-barges. It would often prevent serious accidents, and would save a great loss of time.

* I observed upon the canal several very flat boats, the water-lines of which were perpendicular to the direction of the current. According to the lines of the greatest slope of the prow, and in the planes parallel to the keel, projecting iron-bars are fixed. In winter, those boats are used for cutting the ice, which would otherwise preclude the possibility of navigating. Those ice-cutters set out every morning before the passage-boats, which nothing must delay.

Nothing can be more striking, when standing on the left bank of the Clyde, than to see vessels on a level with the soil; and, above the town, other vessels raising their masts in the air. From port Dundas we go down to Glasgow by a rail-road, which we noticed in Vol. I.

The canal leads, by a branch of two miles and three-quarters, to the Hill of Hamilton, situated on the North of Glasgow; in this place a basin has been dug, seven acres and a half in superficies, surrounded by wharfs and warehouses; it is called Port Dundas*.

Union Canal.

In order to give the canal of the Forth of Clyde all the utility of which it was susceptible, it had been suggested to continue it, in a direction parallel to the south bank of the Forth, to the town of Edinburgh. This was done in 1822, by Mr. Baird, the able engineer of the canal of the Forth and Clyde. At the fourth lock of

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* Port Dundas is not the only basin constructed for the use of the canal. Near to the aqueduct of Kelvin, and at the mouth of the canal, in the Clyde and the Forth, dry docks have been made; they are shut by gates, and can be made quite dry for the repairs of vessels.

The canal communicates with the Clyde, by a spacious basin, the axis of which forms, with the direction of the river, a very acute angle. The passage from the basin in the river is protected by two piers, or spurs, compactly built, and by two embankments, which, to a considerable distance, bound the bank of the river. A light-house with six lamps is built upon the upper pier.

On the side of the Forth the canal opens into the river Carron, by a large basin, in which the vessels, arriving from that gulf to enter the canal, are arranged. Chains secure the sea-gate, which is exposed to the pressure of the rising tide. It would have been better to prolong the canal to Borrowstowness upon the right bank of the Forth, because there the depth of water is more considerable at ebb tide. An act of parliament sanctions this improvement.

the latter, in descending from the east, commences the Union Canal. It rises at first 110 feet, by eleven locks*, to reach the height which permits it to pass by Falkirk and Linlithgow; it then follows a level line, twenty-six miles long, as far as the city of Edinburgh; a short tunnel and two large aqueducts, plated on the inside with iron, are the chief works of art on this canal, which it is intended to prolong from Edinburgh to Leith, by a railway.

This line of navigation, in traversing a fertile country, rich besides on account of its iron and coal mines, gives a greater value to its produce, and renders, consequently, all the neighbouring property more valuable also.

Monkland Canal.

It derives its name from the Monkland coal mines, the produce of which it serves to convey to Port Dundas. Its advantages, with regard to such a manufacturing town as Glasgow, are invaluable; because it allows its inhabitants to procure at a very low rate the most valuable element of the productions of industry. It was traced out in 1769, on the plans of J. Watt; it is eleven miles and three-quarters in length; its width at the bottom is twenty-five feet; the minimum of its depth of water is four feet and a half. If we follow the Monkland Canal from Port Dundas we find, about two miles hence, a rise of ninety-four feet and a half. This canal had first been composed of two parts on the same level, one above and the other below this rise, and the coals descended it in large boxes, which were made to slide down an inclined plane. In 1790 this plane was replaced, first by four double locks. Each lock is

* It is in contemplation to avoid the descent of the five first locks of the canal of the Forth and Clyde, and the ascent of the five first of the Union Canal. In rising only by six consecutive locks it will be practicable to pass from the first canal into the second. By this arrangement, from Edinburgh to Glasgow, there will be only two different levels to pass.

seventy-one feet in length, and keeps the water at a depth of twelve feet. A little higher we find two more locks, keeping the water at eleven feet and a half.

Since 1813, passage-boats have been established upon the Monkland Canal. The first year they were let for nothing; the second, 100*l.*; the third for 150*l.*; and the fourth for 400*l.* These are the proper means to open a branch of industry!

It is now intended to prolong this canal as far as the Calder, which opens in the Forth, near Leith, and runs through a country rich in iron and coal mines. Branches are also projected, to extend this navigable line in the counties of Peebles, Selkirk, Roxburgh, and Berwick, which, at present, are deprived of the advantages of artificial navigation.

Glasgow, from its trade, commerce, opulence, and population, is, in my opinion, the first town of Scotland. At the period when the legislative union took place, in 1707, Glasgow took the lead in opposing that great political act. The inhabitants revolted, and, to restore them to obedience, it was found necessary to place them under the coercion of martial law; they not only fancied that they saw their prosperity annihilated, but regarded their ruin as inevitable and at hand. We may be able to judge how far they were mistaken, from a plain statement, showing the progressive increase of population; it rose by degrees: in 1707 to 14,000 souls; in 1807 to 114,000; in 1821 to 147,000.

We now proceed to give an enumeration of the great works which have been executed, and the establishments formed at Glasgow, since the union. This list, accompanied with dates, will show the progress

of its industry and opulence more satisfactorily than long comments.

In 1718, the city was lighted by lanterns; in 1818 by gas; 1727, the society founded for the improvement and civilization of the highlands; 1730, first glass-house built; 1733, first local bank established; 1753, first theatre the town possessed, and the first coach kept by an inhabitant; 1767, a stone bridge built over the Clyde, 501 feet long, and thirty feet broad, between the parapets; 1777, act passed for building an exchange; 1783, chamber of commerce founded; a branch of the royal Scotch bank established; 1787, New Town began; Sunday-schools founded for poor apprentices who have not time to study on week days; 1788, new grammar schools founded; 1790, commercial hall and surgeons' hall built; 1795, Andersonian institution founded, for teaching the sciences applicable to manufacture; 1799, quay on the right bank of the Clyde lengthened 360 feet; 1804, new bridge over the Clyde; first fire assurance company established; 1804, 1806, 1808, three companies formed successively to supply the town with water; 1808, bank of Glasgow founded; 1810, the prison, the courts of justice, the lunatic asylum, the post-office, the Lyceum, and the observatory were erected, and the quay on the north side of the Clyde was lengthened 900 feet on account of the increase of shipping; 1812, the first steam-boat sailed upon the Clyde; 1818, the savings-bank established.

Glasgow is not less conspicuous than Edinburgh for its old and new monuments*.

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* We shall notice, 1st, an obelisk 141 feet high, built upon a large terrace, in honour of Nelson; this obelisk was struck by lightning, which cleft the summit of the spire. 2nd, the statue of Pitt, in white marble, placed in the town-hall. 3rd. The statue of General Moore, a Scotchman, who was killed at Corunna, at the head of his army pursued by the French, and taking refuge on board the British fleet. Among the public edifices of Glasgow

Among the buildings appropriated to public utility the barracks*, the markets †, and the shambles ‡

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let us mention the vast cathedral, preserved with its rich sculptures from the attacks of Knox and his sectaries, by the firmness of the corporations of trades; several modern buildings, remarkable on account of the elegance of their architecture, more especially the Catholic chapel, built only since 1815, by voluntary subscriptions. Will it be credited, that in Glasgow the Catholics had not the rights of burgesses until 1793, so tardy is the fanaticism of the Presbyterians in its concessions! One part of the edifice of the university is very old, and the other quite new. The library of this university receives, like those of Edinburgh, St. Andrews, and Aberdeen, a copy of every work published in Great Britain. Let us now pause before the Hunterian museum, built in 1804, near the university, by the munificence of Mr. Hunter, who left 8000*l.* for that purpose, having previously given his valuable collection to his fellow-citizens.

Let us now visit a public building called the Tontine: there the respectable inhabitants find the English, the Scotch, and the French newspapers. The expenses are defrayed by about 1,200 subscribers, each of whom pay two guineas a year. Strangers may enter the Tontine, sit down and read, without the least formality. The Tontine is of its kind the most liberal establishment in Great Britain, and, I will add, the most favourable to commerce.

* The barracks occupy, towards the west end of the town, a very extensive area. Three large masses of buildings are placed upon three sides of a rectangle; the fourth side is occupied by a wall and railing which bounds the public road. The officers' apartments are opposite to the railing. The lateral buildings, appropriated to the soldiers, contain twenty-four kitchens and seventy-two chambers, each of which receives fourteen men. There is beside, within the walls of the barracks, an infirmary, a canteen, a magazine for the materiel, a detached guard-house, *&c.* These barracks are constantly occupied by troops of the line.

† In the fish-market each stall is furnished with a pipe supplied from the water of the town: the occupier has only to turn a cock to water the fish exposed for sale.

‡ The slaughterhouses are divided into seventy-seven compart-

merit particular attention, on account of their judicious distribution, their regularity, and extreme cleanliness. Before the construction of the new markets at Newcastle, those of Glasgow were reckoned the most complete in Great Britain.

Public Works.

Of the most important public works, we must include the lighting of the streets by gas, which was begun in Glasgow, upon a very extensive plan, in 1817. It is an example of what our cities of the first class will do in this way, if they do not listen to the sophistry of some of our fastidious *beaux esprits,* who decry this mode of lighting, because it is *new*, and (what foreigners will scarcely believe) because it gives *too much light!*

The means employed for supplying Glasgow with pure and wholesome water are no less worthy of attention*.

An establishment of which I have not seen any

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ments; there are two courts for the live cattle, and two alleys or streets which facilitate the communication and the cleansing of the different parts of the establishment. The slaughterhouses, courts, and passages are paved with large flag stones; pipes, laid down in the slaughterhouses, provide them with pure water in abundance; sewers receive the dirt, which a stream of water sweeps away with the other filth of the town.

* By means of a steam-engine, water is raised from the Clyde to a height of seventy-eight feet, in order to direct it to a hill on the west side of the town. Here it remains at first in a large quadrangular reservoir; it afterwards runs off through four iron pipes

thing of the kind elsewhere, is a house built by the town, upon the bank of the Clyde, where every family can wash their linen, and have it kept in safety, at a very moderate charge.

Let us now advert more particularly to the institutions which conduce to the progress of industry, and of the knowledge that directs it.

In 1788, a merchant of Glasgow, Mr. Couter, among many other legacies bequeathed to his native city, appropriated a capital of upwards of 5000*l.*, for the purpose of giving an annual prize to the person who should invent or improve the machine the most useful to the arts.

In 1795, Anderson, one of the professors of the

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into four long channels, dug in the middle of a bed of sand collected expressly for the purpose. These channels, made at ten feet from one another, and parallel, are fourteen feet broad at the surface of the ground.

At about four feet under the bottom of each of these channels, a bed of paving-stones has been formed so as to rise towards the middle, which correspond with the centre of the channel under which it is; then there are drains corresponding with the middle of the interval between the channels, and upon these ducts or drains, which extend all along the four channels, and even farther, to reach a reservoir for the purified water, are built small arches of stones, without mortar, and irregularly laid, in order to leave numerous interstices; these stones are covered with pebbles, over which a layer of sand is spread, and of these materials the bottom and sides of the ditches are composed. It is easily perceived how the water filtering through these strata falls into the sub-channels, which, by a well-adapted inclination, convey it to the reservoir of purified water; whence it is conducted by syphon-pipes, in a state of perfect purity, even to the upper stories of the houses, in different quarters of the town.

university of Glasgow, founded, for the encouragement of industry, the Andersonian Institution*, endowed it, and left it his library, his collection of instruments, *&c.* In this establishment, young artists are instructed in mathematics, geography, natural philosophy, chemistry, physics, and pharmacy; chemistry, as applicable to the arts, is professed by Doctor Ure. I am greatly indebted to the extreme kindness of this learned man, for having become acquainted with the industry and institutions of a town so worthy of being studied.

We must name, with a feeling of enthusiasm, the foundations established in Glasgow, for instructing the children of the indigent classes. Twelve Sunday-schools, and six others, called Sabbath-schools, admit at once nearly 2000 pupils. To each school is attached a small library, the books of which are

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* The administration of the establishment is conducted on a plan which deserves to be known. It is submitted to the superintendence of a general committee formed of nine classes, consisting of nine members each. These classes are, 1st, the corporation of town trades, 2d, agriculturists, 3dly, artists, 4th, manufacturers, 5th, physicians and surgeons, 6th, lawyers, 7th, clergy, 8th, savans, 9th, relatives of the founder. Each class annually elects an agent to represent and act in its name; the nine agents elect, in like manner, their president, secretary, and treasurer.

The professors are chosen, by a majority of votes, by the eighty-one commissioners. The accounts of the nine representatives are rendered annually to the general meeting of the commissioners, who are elected for life.

Be it remarked, that the government has no concern or influence directly or indirectly with this management!!!

chosen for the soundness of their doctrine, and the purity of their morals. To increase this library, the parents of the pupils contribute, if they can, one penny per month. In these schools, the governors, the masters, and monitors, give their services gratuitously. Thirty-five Sabbath evening-schools, founded in the town and its neighbourhood, include 1400 boys, and as many girls. The school of domestic economy for young persons ought not to be forgotten. They are there taught to sew, to knit, and to spin, three evenings in the week, after they are dismissed from their ordinary employment. There, one hundred and twenty young women learn at the same time to become useful housewives, at the rate of one penny per week!

Number of pupils belonging to all the gratuitous schools	6,516
Number of pupils of all the paid schools	10,283

Thus, 16,799 children, of both sexes, at once attend the schools of a single town. This result excites admiration, and explains in a great degree the progress of the arts of industry in the town of Glasgow. In all the work-shops and manufactories that I visited, I found the workmen well informed, appreciating with sagacity the practice of their trade, and judging rationally of the power of their tools, and the efficacy of their machinery. I observed, in the details of a variety of occupations, improvements founded on reasoning, due to that universality of instruction which is to be found among

the working classes of the community. This is a fact which I submit to the consideration of the inhabitants of Lyons, Rouen, Lille, Marseilles, Nantes, Bourdeaux, and of all those of our towns, who can only expect from their manufactures an increase of wealth and fame.

Glasgow possesses three academical societies; the first devoted to literature, the sciences, and the arts; the second, to the natural sciences, as well as to their application to the useful arts; the third, under the title of Literary and Commercial Society, attends chiefly to subjects connected with industry. We ought to have a similar society in each of our large towns, and in our commercial ports. The members would mark out the *statistique* of imports and exports, they would seek the means of opening new branches of trade, and of infusing fresh energy into the old ones; they would suggest to the manufacturer the produce which it would be essential to obtain, and to render it more perfect, more elegant, more durable, or more economical, for the purpose of gratifying the taste or administering to the wants of their native country, as well as of those foreign nations, from whom advantageous returns might be expected.

Glasgow contains three great subscription libraries, and a number of small ones established by associations of mechanics. Each member pays weekly or monthly his quota, which amounts to a penny or two-pence. A steward administers the

funds, buys and lends the books, *&c.* This is another kind of institution which I wish to see introduced into our towns.

The situation of Glasgow is admirable for commerce and manufacture. In its vicinity, there are abundant mines of fossil coal, which is conveyed at a low price along the Monkland canal. By the Clyde, by the Forth, and the canal which unites these two rivers, the productions of which this city is the manufactory or the entrepôt, can be sent to the old and new world, or brought hence by the most direct and economical ways.

Previously to 1707, Glasgow had commercial transactions with almost no other country except Holland, which was done by doubling the north of Scotland, a circuitous and dangerous navigation. By the act of union, it obtained the free entry of its ships into the ports of all the British colonies. Soon, it became for France an entrepôt of tobacco from Maryland and Virginia. In 1725, manufactories of cloth, lawn, cambric, were established within its walls, and these articles constituted the richest portion of the exportations, until the period at which the manufacturing of muslin was introduced. Glasgow is the first town in Great Britain where inkle was manufactured. In 1732, an individual of that city brought from Holland, at the peril of his life, two looms and a man to work them. It is pleasing to trace the origin of a new branch of manufacture. In every country it is

attended with temporary sacrifices, but eventually leads to great gain.

The revolution in North America effected a change in the aspect of commerce, at the same time with the political relations between the old and new world. Glasgow felt it with peculiar severity, from its being almost the only medium of mercantile transactions with that part of America. This intercourse, interrupted during the war, could only be re-established upon new bases, and partly upon an exchange of goods different from the productions formerly offered and admitted.

About the same time, Arkwright introduced the process of cotton-spinning by machinery. The inhabitants of Glasgow seized with avidity this novel mode of manufacture. This was the epoch when their industry made the greatest step, when manufactures of every description were multiplied in a wonderful manner. Flax, hemp, and wool were fabricated with equal success; iron-foundries were established in the very heart of the town. Instead of confining themselves as formerly in manufacturing, merely to suffice for the exchange of cargoes in the colonies, the merchants prepared goods for supplying London and the principal markets in England. They soon extended their commercial relations to all the sea-ports of the European continent.

Glasgow reckons, at the present time, fifty-four large spinning factories, which turn nearly 600,000

spindles. The value of these establishments is estimated at 1,000,000*l*. For weaving cotton, eighteen mills move by mechanical power 2800 looms, exclusive of 32,000 hand-looms. Eighteen factories for printing calico give a new value to the produce of all these looms. Eighteen calendering establishments, moved by the power of steam, are capable of calendering per day 110,000 yards of calico, of dressing the same number without calendering, and of glazing 30,000 yards. Such is the magnitude of one out of the branches of industry which flourish at Glasgow.

At first the mills for spinning cotton were exclusively built upon the streams which imparted motion to them. An unexpected discovery soon permitted these productive factories to be placed anywhere.

An inhabitant of Glasgow has the glory of having conferred upon industry one of the greatest benefits recorded in the history of the arts. Thanks to the genius of the celebrated Watt, the steam-engine is become an universal* impelling power. No engine known till that time offered at so small an expense, in so narrow a compass, a power so great, so steady, and so regular. Watt is one of England's † best bene-

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* The city of Glasgow alone possesses about eighty steam-engines, which supply their impelling power to as many mills or manufactories.

† I attempted to point out the extent of Watt's services in a discourse entitled " Considerations sur les avantages de l'industrie et

factors and brightest ornaments. I asked with much eagerness what brilliant reward he had received from the gratitude of the nation, and my question remained unanswered. It should seem that neither the King nor his Ministers, nor the Parliament, could discover any thing worthy of commemoration in the life or memory of a man to whom the ancients would have erected statues and altars, as they did to Triptolemus, the inventor of agricultural improvements. The ashes of Garrick the performer repose under the sacred roof of Westminster Abbey; and the ashes of Watt lie in the obscure retreat of some unknown burying ground*.

Let us now take a view of the environs of the natal city of the great artist, who was the greatest honour to England.

In ascending the Clyde, we first reach the town of Hamilton, at ten miles and a half from Glasgow, and fourteen miles further on the village of Lanark, famous on account of the cotton factories which the philanthropic Owen possesses in that place. At one mile and a quarter below Lanark, a stone bridge has just been built over the Mouse, near the place where this river throws itself into the Clyde.

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des machines, en France et en Angleterre;" pronounced in the general sitting of the four Academies of the Institute of France, April 24, 1821.

* The public rewarded Watt, by heaping upon him the riches which he had so deservedly earned; the nation has not forgotten its obligations to its memory.—*Translator*.

At some distance above Lanark, and not far from the river, are the famous Lead hills; the very name of these mountains informs us that they contain mines of lead; they are the most productive of any in Scotland. These are the sources of industry in the county of Lanark, which is contiguous to the county of Ayr, on the south-east, and to the county of Renfrew, towards the south-west.

The county of Renfrew is bounded, on the north, by the Clyde; on the east and south, by the province of Lanark and Ayr; Renfrew itself is only a small burgh; Paisley and Greenock are, on account of their population, arts, and manufacture, the important towns in this county. Paisley contains 28,000 inhabitants, most extensively employed in manufacturing gauze, lawn, and, above all, calico, and many other articles. This town and Glasgow are united by a canal, which contributes to their mutual prosperity*.

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* This canal, formed for boats, 110 feet long, 10 feet $\frac{10}{12}$ths broad, is on a level from the left bank of the Clyde to Paisley, and three miles $\frac{1}{8}$th beyond it, on a total extent of ten miles. It has been proposed to prolong it to the harbour of Androssan, to avoid following the Clyde, and making a wide circuit in going to or coming from the main sea to Glasgow. The part of the canal which remains to be made, after rising sixty-four feet, will pass by the towns of Lochwinnoch, Beith, Dalry, and Kilwinning, and will then, by a fall of 110 feet, go down to the harbour of Androssan. At Glasgow, the canal does not open into the Clyde; it terminates at a short distance from the left bank, at a place called Port-Eglington, in honour of the promoter of the enterprise. To facilitate the

In descending the Clyde from Glasgow we find Renfrew situated on its left bank, and at the distance of six miles from that city; at twenty miles, Port Glasgow; at twenty-three miles, Greenock. But before we enter upon a description of the two latter ports, let us inquire what has been done to improve the navigation of the Clyde, below Glasgow.

Nature had not destined this city to be the seat of maritime commerce. The banks of the Clyde lying in general low, in the parts subject to the tides, the waters, at the flux, spread to a great extent, filled large creeks, and not following a confined channel, could not deepen its bed. Sand banks of course accumulated and obstructed the river at a short distance from the town, so much so that a boat rowed only by two men could scarcely pass them. Such were the obstacles to be overcome.

In the reign of Mary, in 1556, the inhabitants of Dumbarton, Renfrew, and Glasgow, agreed to work by statute labour for the removal of the natural obstruction in the river; but the undertaking was far above the efforts of such an association. After the union between Scotland and England, the commerce of Glasgow assuming fresh activity, recourse was had to more efficacious means. In 1755 and 1758, the Clyde was sounded by Smeaton, who gave an account of his operations in a detailed report.

In 1759, an act of parliament sanctioned a project for making the river navigable by means of locks, but this mode was abandoned as impracticable. J. Goulbourne, civil engineer of Chester, submitted a proposal for improving the navigation of the Clyde, by enclosing it between two artificial embankments wherever the width of the channel was too great at high water. In 1769,

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communications of the country, thirty-five stone bridges are built over this canal; there are two subterraneous tunnels in the midst o Paisley, and five aqueducts.

J. Watt made the requisite soundings preparatory to the undertaking; and, in the following year, Goulbourne engaged to excavate the river sufficiently to enable vessels drawing seven feet to reach Glasgow. In order to carry the plan into effect, he constructed artificial embankments upon seventeen of the most important points on each bank*. In 1775, the object was not only accomplished, but the Clyde, in its most shallow parts, was deepened nine inches beyond the stipulated limit; vessels of 150 tons now arrive at Glasgow with the utmost facility.

The act which sanctioned this noble enterprise, authorised the magistrates to levy a duty of one shilling per ton on all vessels which should pass through the parts rendered navigable. The increase of the returns of this duty will show what has been the progress of the navigation.

Years . .	1771	1791	1804	1815
Duty collected	1021	2145	4759	5680*l.* sterling.

A number of steam-boats have been, within these few years, established upon the Clyde; they go daily to Renfrew, Dumbarton, Port Glasgow and Greenock. Others, in the fine season, descend the river, and sail in the open sea as far as Ayr, on the south, and Inverness on the north; they frequently travel 100 miles in the course of a day. The extreme agitation communicated to the water by the paddle-wheels which impel the steam-boat, in being transmitted to the sand and mud at the bottom of the Clyde, has made the river deeper, particularly in the more shallow parts. We purpose giving very ample details concerning the steam-boat, when we come to treat of the means of transport of the Commercial Power.

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* In order to contract the bed of the river, thick stone walls were first built in a transversal direction with the stream of the river, and at some distance from each other; then dykes, uniting the extremities of these walls, have been erected, by which means they compressed the stream into a bed of uniform breadth.

As early as 1818, in our *Memoires sur la Marine*, &c., we cited the grand example of the works of the Clyde, with a view to induce the inhabitants of the banks of the Seine to make that river navigable for sea vessels as far as Paris ; the river would thereby become the most powerful element of wealth and industry to our delightful capital. May we indulge the hope, that our wishes upon this subject will not remain for ever ineffectual ?

Port Glasgow contains between six and seven thousand inhabitants ; it is built around a basin, excavated to serve as a dock for the vessels which are prevented by their weight of tonnage from proceeding with their cargoes to Glasgow. The port possesses 114 vessels, measuring 18,255 tons.

The dock of Port Glasgow is the first that was built in Scotland. It is rectangular, and is not closed by lock-gates ; at high water, the depth is fourteen feet. The quay of the Clyde, beyond this dock, is very wide and very long. The vessels which are in the river, may at high water approach the quay, when they have not occasion to go into the basin. From Port Glasgow to Greenock, the left bank of the Clyde forms an arc of a circle of about three miles in length. Along this line, there are many building-yards which contain docks more or less spacious.

Greenock was only an insignificant village, at the period of the union of Scotland with England ; it is now a town containing 22,088 inhabitants. The mercantile shipping is its principal branch of industry ; it possesses 341 vessels, measuring 46,171 tons.

The gulf of the Clyde extends to a great width below Greenock; but as it is surrounded on all sides by high hills, it affords a safe anchorage. There the vessels which draw too much water to enter Port Glasgow, remain.

Greenock has an open basin, which was, when I visited Scotland, in the course of being enlarged, after a plan of Mr. Rennie. Around the town, many dock-yards are situated, as also manufactories for articles in request for the shipping. I particularly observed a patent rope-manufactory, upon the principle of Captain Huddart. The description which I gave of this process has been the means of improving our maritime rope-factories.

A number of steam-boats pass daily between Greenock and Glasgow, stopping for two or three minutes at the principal intermediate places, to land and take passengers on board. Previously to the establishment of these conveyances, it was calculated that the number of individuals who went from one of these places to the other, did not exceed 500 per week; now upwards of 2000 persons frequently make the same passage in the course of one day. It has been observed, that since the period at which steam-boats have been in the habit of navigating the Clyde, the burghs and villages which border the river have increased rapidly in riches and population,—such as Holmsburg, Rothelay, Oldkirk, Largs, *&c.*, because, during the summer, the new species of navigation renders an excursion to those places for the sake of sea-bathing, cheap and convenient.

On coming out of the Clyde, below Greenock, we turn from the west to the south. We next penetrate the gulf or frith of the Clyde; the right shore of which is bounded by the Isles of Bute and Arran. Between the former and the main land, as we have already mentioned, two small isles are situated near the harbour of Androssan. On leaving this latter place, the coast of Scotland forms a concave line,

and presents to the view the harbours of Irvine, Troonbay and Ayr.

Androssan.—If we examine attentively the irregular form of the gulf of the Clyde, situated between very high lands, intersected by secondary gulfs, wide, deep, the shores of which, being themselves very high, produce sudden squalls of wind of the greatest violence, it will be easy to understand how advantageous it would be for the commerce of Glasgow to have its port in the open bay of Androssan, instead of having it at the bottom of the gulf of the Clyde. From Androssan, vessels will have the facility of putting to sea whatever be the direction of the wind, which they cannot do either from Greenock or Port Glasgow.

But while the canal, which will accomplish this object, is being completed, very extensive improvements are in progress at Androssan. Elegant houses have recently been built upon the beach, which slopes gently towards the south, and is sheltered from the north wind. These houses are surrounded with pretty gardens; they are intended for the accommodation of families, who, during the season, will come hither for the benefit of sea-bathing; indeed Androssan is already a watering-place. The harbour extends to the west of these new houses; when the works for its protection are completed, it will be one of the safest in Scotland. To defend it from the violence of the sea, a long pier has been constructed upon a ridge of rocks, more or less apparent at low water, and forming a salient angle, whose sides extend from the land to the west, and from the west towards the north. At some distance beyond the head of this mole, there are shoals, upon which a light-house of a quadrangular pyramidical shape is erected. The

entrance of the harbour exhibits two passes, the one directed from east to west, between the pharos and the mole, the other from south to north, between the light-house and the land.

Within this mole, a wet dock, capable of containing 100 vessels, drawing 16 feet water, is being excavated in the solid rock. An immense dam of stones, earth, and rubbish, was first made to isolate the space which it was intended to excavate. The walls, forming a quay around the basin, are built upon the rock, with the very stone extracted from the excavation. Their surface is flush, without any buttresses, and having but very little slope.

The entrance to the dock is to be placed behind, and very near the head of the mole. The dock will extend longitudinally from east to west, between the mole and the land. The fishing-boats and small coasters will be received into a creek, naturally sheltered by the quays of the dock*.

The large outside mole, whose elbow-like shape is rounded, instead of presenting a continued curve, is a polygon, composed of a number of rectilineal sides, forming with each other very obtuse angles. The same plan is adopted for the quay, built within these few years in front of the Arsenal at Woolwich, upon the right bank of the Thames.—(*Vide Military Power.*)

Near the port, a hill is being reduced by mining. The fragments in blocks, of larger or smaller dimensions, are carried upon a long rail-way to the very place where they are used, whether to

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* Upon the margin of the dock they are now constructing a building dock. It is composed of semicircular steps at bottom, and rectilineal ones at the sides as far as the entrance. In the middle of the rectilineal sides are two stairs, communicating with the bottom of the dock. On each side of the flight of stairs is a slide, by which timber and other materials are let down. Four or five small and one large steps are alternately placed: the height of the small ones is equal to their breadth, but the large ones are higher than they are broad.

fill up, or as proper materials for the coating of the quay*. I observed wooden cranes employed at these works†.

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* The small wagons used for this sort of conveyance deserve a particular description:—A platform, fixed to the axles of the vehicle, carries four wheels, placed at equal distance: the planes of the four wheels are tangent to the circumference of the same circle: a flat circle, fixed under the body of the wagon, rests at once upon the four wheels: the wheels and the circle are of iron: the body is formed of a quadrangular trunk, elongated in the direction of the draught: the iron circle is fixed upon a frame, under the hind part of the bottom of the body; consequently, the fore part of the body is salient: the frame, at its fore part, is attached to the bottom of the body by a double hinge, so that the body can easily be tilted at pleasure. It is sufficient for the purpose that the centre of gravity of the body, and its load, should be a little behind the vertical plane, passing through the hinges. When there is stability, it may be easily understood that the slightest force will destroy it. When the wagon is required to move, the hind part of the body being hitched to the platform fixed to the axles, it cannot tilt. The driver hooks the traces of his horse to the fore part of the platform, and he sets off.

Having arrived at the part of the rail-way at which the wagon is to be unloaded, the driver first takes off his horse; secondly, with the assistance of the man who is stationed at the point of unloading, he unfixes the body of the wagon, and turns it at an angle of 90 degrees: thirdly, the driver takes out the pins fixed to the frame, resting upon the iron circle turning upon the wheels: fourthly, in the interval the assistant takes off the board which closes the fore part of the body, and presses upon it, to make it tilt: the contents then fall on one side and out of the rail-way, and roll down the declivity at which they are discharged. This wagon is evidently constructed so as to discharge its load forward, if required, without the necessity of turning the body.

† These cranes are composed, first, of a high piece of timber, kept in a perpendicular position by tackles which are fastened upon iron staples or rings, made fast in the rock; secondly, of a horizontal cross-beam mortised at one end, in the upright piece of

Mr. Telford has furnished the plans for the works at Androssan. According to his estimate, the wet dock will be 330 yards long by 110 broad. It will be dug so deep as to contain a height of water of 16 feet, for 80 or 100 vessels of heavy tonnage. The jetty on the south side will be 660 yards, and that on the north 330.

To the south-east of Androssan, we find the small town of *Saltcoats*, which possesses nothing worthy of notice. Its traffic is of the same sort as that of Irvine, of which we shall speak presently. In pro-

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timber, with which it is joined above and below by an oblique piece of wood, forming a brace.

At the projecting extremity of the traverse, and against one of its sides, a small metal wheel is fixed. Upon the correspondent face of the upright, and towards the top, a second wheel is fixed. The chain for raising the weight is attached outside the wheel of the cross-timber, quite at its extremity. From thence the chain passes, first, into a wheel, or pulley, on which are fixed the hooks which take hold of the load; secondly, over the wheel of the cross-beam; thirdly, over the wheel of the upright piece of timber; the chain then drops down the upright, and is rolled upon a horizontal cylinder, or barrel, secured at the foot of the upright, and set in motion by means of a cog-wheel and pinion, moved by a double winch. An iron socket, half buried in the ground, receives the point of a salient pivot; the point of the pivot, which is of iron, is sunk like a ball in the foot of the upright. The ropes are fastened at top to a collar, in which the head of the crane turns freely, when the weight which the machine bears suspended, or the chain which serves to suspend the weight, is drawn by the hand. Cranes upon this construction may be easily shifted, if required; first, by gradually advancing the socket which sustains the upright; secondly, by slackening the ropes behind, straining those in front, and by occasionally changing the position of the iron staples, by which the ropes are fastened to the ground.

ceeding by land from Saltcoats to Irvine, we pass through the village of Kilwinning, famous in the annals of freemasonry.

Irvine, built upon the left bank, and near the mouth of the river of that name, reckons 5000 inhabitants, whose chief trade, like that of Saltcoats, consists of the export to Ireland of the fossil coal of the county of Ayr. It is well known that Ireland possesses few coal mines, and does not work any. The number of registered vessels at Irvine is 121, measuring 10,487 tons. The shipping can sail from the harbour, at low water, towards the right bank of the Irvine, along a very extensive quay, protected by a wall. This river, like all the rivers in Scotland, is greatly obstructed at its mouth by a bar, produced by the sand which it deposits, and by that which the sea throws back. In this instance the bar is the more formidable, as the mouth of the Irvine is situated at the bottom of a bay of a very gentle slope, and showing, at low water, an immense sand-bank.

Troon.—Two small bays present, at the projecting point which divides them, a fine mole* in the shape of

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* The outside and inside courses are composed of granite cut at right angles at the joints, and left quite rough on the outward face. What is remarkable in these courses is, that their longitudinal direction is not horizontal; it is inclined at forty-five degrees. Such a disposition occasions the sea, in striking them, to glide off upon the joints, to escape more easily, and to decompose the force of its concussion, according to the obliquity of the courses. Another

a horse-shoe; it is almost finished, and constitutes the shelter of one of the finest harbours in the west of Scotland. To complete this harbour, a large wet dock is excavating; it is of a quadrangular figure, sheltered by the mole now building, with the blocks of granite got from the excavations.

The entrance of the dock will face the north. The four walls are very nearly in the orthogonal directions to the equator and meridian. At Troon, the filtrations are hardly perceptible, for the same reason as at the works of Androssan. The small quantity of water which does penetrate into the basin is expelled from time to time by a small steam-engine. This machine is likewise used for raising the wagons used in removing the blocks hewn in the basin, which was excavating when I visited Scotland.

To the east of the wet-dock, a fine building-dock * has just been

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reason assigned for giving them this inclination is, that the bottom of the rock upon which the mole is built, being of a very irregular shape, it is at once more easy and more solid to cut the rock in indentations, with small faces inclined at an angle of forty-five degrees, than in horizontal planes of considerable dimensions. A common horizontal course covers the inclined courses, and forms the parapet. On the mole towards the sea there is a parapet of six feet in height. The object of this unusual dimension must be to protect the interior quay against the violence of the sea.

* The steps of this building dock are all of the same dimension; at the bottom of the circular part is a hollow slide about six feet wide. On the straight sides are also two slides, one placed at one-third and the other at two-thirds of the total length—these slides are three feet four inches wide. The gates are 36 feet $\frac{6}{12}$ths wide,

finished. Near it, is a saw-mill worked by steam; still farther to the east we see a slip, and then an old dock, cut out of the solid rock. In several places of the old dock the labourers have contented themselves with rudely cutting the granite in its natural bed to shape the steps, which correspond nearly with those that have been regularly cut by art.

From the promontory where the harbour of Troon has been formed, the entrance of the Clyde presents a magnificent appearance. Upon the foreground the isles of Arran and of Bute, and the peninsula of Cantyre in the back ground, mark the western coast in the most picturesque and imposing manner. The opposite shore displays a flat country, which extends from Androssan, Irvine, and Kilmarnock, as far as Glasgow. The line of the Androssan Canal has been marked out through this level country.

Between the harbour of Troon and Kilmarnock, a town and parish containing 12,796 souls, a double iron rail-way * has been put down for the loaded coal wagons and the return of the empty ones †; for the

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twenty feet high; height of the water at common tides thirteen feet, at spring tides sixteen feet $\frac{4}{12}$ths. The gates are convex on the part which resists the pressure of the water. The steps inside the dock begin at above thirty feet from the entrance. The sides, as far as that spot, are vertical and flush.

* The works at the harbour of Troon, as well as the rail-way to Kilmarnock, are conducted almost wholly at the expense of the Duke of Portland. His Grace has expended above 50,000*l.* upon this road alone, which is ten miles long. What a laudable use of power and wealth.

† A single horse draws with the utmost ease five tons weight

chief and almost only trade of Troon consists, as yet, of the coal sent to Ireland. As this harbour happens not to be at the mouth of a river, there is no bar to be dreaded; an inconvenience which, on the contrary, is severely felt at Ayr.

Ayr.—The capital of a county, and containing about 7,000 inhabitants, is built upon the banks of the river whose name it bears, at a short distance from the mouth of the Doon, another river, the bar of which is so formidable that no vessel can attempt to pass it.

This town does not possess any monuments worthy of notice. Cromwell built a citadel in its vicinity when he subjected Scotland to the Commonwealth of England. He converted at the same time the tower of the cathedral into an armoury. This wonderful man, who harangued and fought with the bible in his hand, felt no compunction in demolishing religious edifices, or applying them to profane purposes, whenever he could make them subservient to his interest or ambition.

The harbour of Ayr begins below a bridge of four arches, built over the river, between the town and the north suburb. Two piers of stone and wood, which are prolonged to a distance of 550 yards on the right and left of the river, serve for the mooring

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from Kilmarnock to Troon, and returns with the empty wagon against an ascent of $\frac{1}{507}$th. The stage-coach which traverses along the rail-road has four iron wheels; it is long like a caravan, and might, I think, be drawn full of passengers with only one horse.

of ships which come to take in cargoes of coal, close to wharfs similar to those of Sunderland and Tynemouth.

Ayr reckons fifty-seven vessels, measuring 5711 tons, the greater part of which are employed to export coal, in which the surrounding country abounds. The coal is brought to the wharfs on iron rail-ways.

South of Ayr, there are besides two small harbours without importance; they are Girvan and Ballantire, at the mouth of the Gurvan and Stincher.

CHAPTER VI.

Basin of the Solway.

The Basin of the Solway includes the following counties:—

Counties.	Population.	Square miles.	Inhab. per sq. mile.
Wigton	33,900	445	73
Kirkudbright . . .	39,700	834	47
Dumfries	72,300	1263	57
Totals	145,900	2542	59

The small county of Wigtown, which, towards the north, borders upon the county of Ayr, and to the east, upon that of Kirkudbright, is separated from Ireland only by the north channel.

Port Patrick is situated at the narrowest part of the channel. Two great roads, the one from England and the other from Scotland, terminate at this port; they answer the double purpose of the mails, and of commerce with the north of Ireland, particularly with Belfast. Within these few years, government has done a great deal for the improvement of Port Patrick*, and the public roads which ter-

* It has been considerably deepened by means of the diving-bell, such as we have described it. *Vide Naval Power*, vol. ii.

minate there. It is situated upon a peninsula, formed, on the north-west, by the gulf of Ryan, which has a fine anchorage at Cairn. At the bottom of this gulf appears Stranraer, which possesses fifty-one vessels, measuring 2478 tons.

The bay of Luce, which terminates the peninsula of Wigtown, on the south-west, has not any harbour worth mentioning.

In the east of the bay is situated the gulf of Wigtown, so called from the small town which also gives its name to the county. The town is built upon the western bank of the gulf, which receives the waters of the river Cree, on the other side of which begins the county of Kirkudbright. The gulf of Wigtown, in like manner, receives the waters of the Fleet and of the Dee, which empty themselves in a small bay to the west of Kirkudbright, a town which reckons 2595 inhabitants; it registers forty-six vessels, measuring 2112 tons. Near this place, we observe the village of Gatehansfleet, where extensive cotton-mills have within these few years been established.

In advancing towards the east, we enter, properly speaking, the gulf of Solway. At its north bank, the Orr discharges its waters, as also the Nith, another river which is navigable to Dumfries.

The county of Dumfries, the last of Scotland towards England, lies on the western coast, and is much more important than the two preceding, on

account of its population. The counties of Kirkudbright, Ayr, Lanark, Selkirk, and Roxburgh, surround it on the west and north; on the south, it is bounded by the sea; on the east and south-east, it touches England.

Dumfries, the capital of the county, constitutes a parish of 11,052 inhabitants; it possesses seventy-five vessels, measuring 4951 tons. Vessels may sail up the Nith as far as the town. Two bridges cross this river; the one, which is very old, has nine arches, and the other, built in 1790, has only four.

The small harbour of Annan, near the mouth of the river of that name, is, with the exception of Dumfries, the only one that the county possesses.

In travelling from Dumfries to Carlisle, we pass through Gretna-Green, a small village upon the right bank of the Esk, the boundary between Scotland and England. It is needless to repeat, after a thousand writers, that it is at Gretna where young English ladies repair with the lovers whom their hard-hearted parents or guardians will not allow them to have, in order to be married. In England, the *theory* of elopement is very refined; it is the young lady who is supposed to run away with her future husband in order to prevent his being prosecuted for rape and seduction*.

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* Our *scientific* observer is a little out of his line here, and may therefore be allowed to blunder.—*Translator.*

BOOK V.

WESTERN COAST OF ENGLAND.

CHAPTER I.

Coasts of Cumberland and Westmoreland.

In 1821, these two counties presented the following results:

Counties.	Population.	Square Miles.	Pop. per mile.
Cumberland . . .	159,300	1478	108
Westmoreland . .	52,400	763	61
Total . . .	211,700	2241	84

At the extremity of the Solway Frith, the Esk separates Scotland from England. At the place where the great northern road crosses this river, a cast-iron bridge of three arches is about to be built. At a short distance from this place, we meet the Eden, another river which receives the waters of the Calder, at Carlisle, the capital of Cumberland.

Carlisle has 15,476 inhabitants, and reckons thirty-seven ships, measuring 2266 tons. The commerce and industry of that town are thriving. The principal manufactures are stuffs of cotton, linen and

silk, stockings, nankeens, sail-cloths, ropes, *&c.* The only buildings of this city worthy of notice, are the cathedral, the courts of justice, and the old castle.

The cathedral was formerly a very large building; but during the civil wars, above ninety feet of its nave was demolished, to make room for barracks and batteries. The choir is the handsomest part of the building, and in better preservation than the rest.

The courts of justice, which also comprehend the county-gaol, are two spacious square buildings, in the Gothic style, though of recent erection; in the centre is a rotunda which contains the audience-hall. These buildings are not in the most perfect taste; but the effect of the whole is imposing.

The ancient castle, which is built of a stone of a reddish colour, has its walls supported by external buttresses, which are very large, jut out very considerably, and stand very close to each other. It is built at the angle of the confluence of the Eden and the Calder, which rendered it formidable, according to the system of ancient warfare. It was the western bulwark of England against Scotland.

The famous wall raised by the Romans in the time of Adrian, to protect the Britons against the invasion of the Caledonians, commenced on the left bank of the Solway Frith, passed to Carlisle, and terminated at Newcastle. The military road formed

by the English government between Newcastle and Carlisle, follows the course of this wall, throughout the greater part of its extent. We have seen the Scotch follow the direction of the defensive wall of the Romans, proceeding from the Forth to the Clyde, in order to open a canal between the two seas. The English have traced a line from Carlisle to Newcastle, which is intended to operate as a similar junction, extending from Carlisle to Workington, through the vales of the Tyne, the Eden, and the Derwent. The total length of this new line of navigation was to have been ninety-three miles, but hitherto they have confined themselves to the opening of a canal on large section, from Carlisle to the Solway Frith, a distance of seven miles and a half; the length of the locks is seventy-five feet and a half; breadth seventeen feet; depth eight feet. A bridge of five arches has been thrown over the Eden; they are of equal size and elliptical, after the manner of modern bridges; the piers are terminated on both sides of the bridge, above and below, by demi-circular cylinders, surmounted by a demi-cone, equally circular. This bridge merits our admiration on account of its structure and noble simplicity.

We will now go down the Eden, and come out on the southern shore of the Solway Frith. In turning towards the west, we visit several ports worthy of attention, on the coast of Cumberland; they owe their riches to the coals produced by this county, and

shipped for Ireland and the Baltic, in exchange for timber, iron, linen. *&c.*

First—*Mary-Port,* which, eighty years since, could boast but one tolerable house, with some forty or fifty huts, now possesses a population of 3514 inhabitants. This town is situated at the mouth of the Eden, the banks of which have been protected by wooden piers and stone quays for the facility of loading and unloading vessels. Mary-Port is at the same time the centre of a fishery, and a place resorted to for sea-bathing.

Second—*Workington* stands at the mouth of the Derwent, over which a bridge of three arches was built, in 1763. From this town, though to a distance of 310 miles, salmon is conveyed to London on horses, which run post night and day. Workington, which reckons 6439 inhabitants, has erected many manufactories and founderies, both within its walls and in its neighbourhood, particularly near the banks of the Derwent, which is navigable to Cockermouth, at the confluence of this river and the Cocker. Cockermouth is a manufacturing town, reckoning 3790 inhabitants,

Third—*Whitehaven,* which, at the beginning of the sixteenth century, was inhabited by only six fishermen's families, possesses, at the present day, 12,438 souls; it has 526 ships, registered in its port, measuring together 74,661 tons. This is the haven into which colliers, on their passage from

Great Britain to Ireland, run for shelter in stormy weather. When contrary winds shift, after having lasted some time, it is no unusual sight to see from one hundred and fifty, to two hundred vessels quitting the port of Whitehaven at the same time.

Whitehaven trades to Africa, the United States, and the English colonies in America. It was in the reign of Queen Anne that its port began to be excavated, and protected by a mole, which was afterwards considerably enlarged. A light-house erected near its entrance, serves to guide the vessels which are making the port. The coal works carried on in the neighbourhood of Whitehaven are very important, and do not yield in this respect, as well as in their extent, to those of Newcastle itself.

Fourth—*Ravenglass* is a small port at the extremity of a bay, at the mouth of the Esk; it scarcely deserves to fix our attention. A great oyster fishery forms the principal resource of this place. On advancing to the south, we find, in a deep gulf, the port of Ulverstone, which reckons 4315 inhabitants; it flourishes by its manufactories, foundries, *&c.* By means of a very short canal, ships of 150 tons can come up to the town. The county of Westmoreland possesses no port worthy to be noticed.

CHAPTER II.

Basin of the Mersey, Liverpool.

UNDER this head we comprehend the two following counties:—

Counties.	Population.	Square miles	Inhabitants per sq. mile.
Lancaster . . .	1,074,000	1830	587
Chester . . .	275,500	1052	262
Total . . .	1,349,500	2882	374

In our preceding volume, we have explained one of the principal causes of the great prosperity of these counties, in describing the beautiful system of inland navigation established there. This system combines happily with the maritime navigation, which, in these same counties, possesses the ports of Lancaster, Preston, Liverpool, and Chester.

Lancaster is the capital of the county, the name of which it bears. It reckons 10,144 inhabitants, and 85 vessels, measuring 9111 tons. It is situated on the banks of the Loyne, a kind of torrent-stream, the mouth of which is obstructed by a bar*. On

* The shallows in the river, below Lancaster, oblige the larger vessels to anchor at the mouth, where they unload on small lighters.

the left bank of this river a very long quay has been built on the side of the city, for the accommodation of vessels; the other bank contains the suburbs of the city, with which it communicates by means of a bridge with five arches.

The most remarkable building in Lancaster is its castle, which now is used as the county gaol*. Its towers were successively built by the Romans in the time of Adrian, by the Anglo-Saxons, and by the followers of William the Conqueror.

Lancaster was long celebrated for its manufacture of sail-cloth; merchant vessels are also built here, and many other branches of industry cultivated with success. Its trade is principally with the English colonies of America.

Preston has 24,575 inhabitants, and reckons 43 vessels, measuring 2507 tons. This city, situated in the centre of a fertile country, upon the banks of the river Ribble, and of the Lancaster canal, at a very short distance from the sea, and at the junction of six important roads, unites all the elements of commercial prosperity. It is, at the same time, a very industrious town; it has many establishments for spinning and cotton weaving. A prodigious number

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* Since the Act of Parliament for the Amelioration of Prisons, Lancaster Castle has undergone some considerable alterations. Its form is irregular; there is neither unity of plan nor of style in its different orders of architecture; but its aspect is, nevertheless, grand and imposing.

of public coaches, carriages, and stage-waggons, are seen going and coming from Preston every hour in the day. Descending the Ribble, and turning to the south, we come to a coast which presents no sea-port, till we arrive at Liverpool, on the right bank of the Mersey.

Liverpool, towards the commencement of the last century, possessed scarcely 5000 inhabitants, and its whole shipping consisted of a few fishing boats. At present it reckons 118,972 souls; it has 1113 vessels, measuring 173,783 tons, and manned with 10,338 sailors! These numerous vessels rival those of the metropolis, and, like them, trade to all parts of the world. Some idea may be formed of the progress of its commerce by the following table, comprehending the number of vessels which arrived from Ireland and foreign parts in the port of Liverpool.

Years,	1760	1770	1780	1790	1800	1810
Ships (Number)	1245	2073	2271	4223	4746	6729
Customs (Duty)	£2330	4143	3528	10,037	23,379	65,782

This prosperity was not the fruit of chance; neither was it the result of the gifts of nature; for Liverpool is situated upon the banks of a dangerous bay, and at the mouth of a river where nature could only be subdued by the efforts of art. And yet, Liverpool, placed in the centre of the western coast of England, opposite Dublin and the Isle of Man, was, nevertheless, the point at which the main

communication of this island and the west of Ireland, with the east and the centre of England, was to be established. In fine, Liverpool necessarily became the mart of the western coast of Scotland.

The more laborious of the Irish, flying from their native land, which was torn by factions, and sacrificed to the jealousy of the mother country, brought to Liverpool their energy and their habits of economy. It was then that a contention in industry took place between this town and the other maritime towns of the western coast of England. Chester and Lancaster, as being more in its vicinity, were the first to yield. At the period of their decline, many of the opulent houses transported their commercial activity into this focus of newly-risen prosperity. The competition on this coast was soon confined to Liverpool and Bristol alone.

Every great mercantile port is a point from whence the produce, of which it is the depôt, is sent in every direction; and which, in order to keep up a constant supply of its exports, draws together the produce of the towns and country by which it is surrounded. When two ports are established in the same county, they extend the sphere of their commercial relations to an intermediary line, more or less distant from either of them, according to the nature of the countries which separate them—to the state of the roads and the internal navigation—the wants and taste of the countries, *&c.* Thus, by the establishment of Liverpool, Bristol, which with

London divided the commerce of England, and which possessed almost the whole of that of Ireland, saw her mercantile territory circumscribed and reduced to one-half, in the three kingdoms; she, however, retains this half still.

The foreign trade could not easily admit of such a share. The distance between two ports of the same island disappear when compared with the vast distances from Europe to Southern Africa and America. This trifling difference between them is not perceptible to the eye of the seaman. The superiority remains then with the mercantile genius, which conceives great speculations, with the daring spirit that executes them; and, finally, with that spirit of economy which produces great profits, increases them by a proper use, and even finds them in itself, and multiplies the number of purchasers, by holding out to them the advantages of moderate prices.

Such are the talents which distinguish, in a particular manner, the merchants and ship-owners of Liverpool. No sooner had they obtained their fair proportion of the inland commerce of Great Britain, than they extended their views towards America. Instead of waiting inactively till the produce of the European continent should find an indirect way into their ports, before it reached the consumers of the new world, they endeavoured to find upon the very soil of their own country products equal, if not preferable, in quality. Scotland furnished them with various stuffs, and Ireland with linen, for the Ame-

rican planters, whom Bristol had formerly supplied with the manufactures of Germany. Immediately Manchester, then rising in the vicinity of Liverpool, made this latter town the depôt of its cottons and stuffs, the beauty, abundance, and moderate prices of which soon set all competition at defiance.

This first victory having been obtained in the English possessions, Liverpool hastened to extend her commercial conquests over the Spanish possessions. A company had just obtained the privilege of importing goods into the colonies, and exacted a duty upon the commodities required, which was four times the amount of what the consumers had been accustomed to pay. By the aid of the Liverpool vessels, a smuggling system of trade was soon established from the English Islands to the Spanish Main; and this fraudulent traffic was carried on with as much boldness as it was with perseverance and success. We shall return to this subject in treating of *the External Commercial Power.*

By means like these Liverpool accumulated immense capitals, but far from resting content, she opened new channels of prosperity, from sources not less fruitful, and not more pure.

Bristol had for a long time past been in possession of the slave trade for the supply of the English colonies; this was also to be disputed with that city; Liverpool must first share it, in order to monopolize it afterwards.

In southern America, under the imbecile govern-

ment of the Spanish cabinet, a monopoly was established for the supply of slaves, as in every other importation. This was a new line of contraband traffic that presented itself—Liverpool at once assumed the character of the legitimate manager of this concern, and the traffic in the *human species* was carried on with no less success than that of other branches of merchandise*.

The war of independence carried on by the Anglo-Americans was, doubtless, injurious to the commerce of Liverpool; but, peace once established, the United States, which assumed a great and rapid increase, both in riches and population, made this port their principal European market. Every year they poured in immense sums for the purchase of coal, manufactured cottons, pottery, iron, both wrought and unwrought, *&c.* It will suffice to say, in fine, that a commercial treaty with Portugal having given to England the monopoly of the Brazils, Liverpool obtained the principal share of the immense advantages.

Such are the means by which a city, which not more than a century since carried on but the *two-and-fortieth* part of the total commerce of England now

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* It is to the slave trade that Liverpool owes a great part of its rapid increase. They were pointing out with pride, to the painter Fuseli, the vast streets and splendid monuments of this newly-sprung town. "Yes, these buildings are very superb; but," rejoined the severe artist, "I cannot help imagining that I see the blood of the negroes oozing through the joints of the stones."

embraces the *sixth* of it; it has therefore enjoyed a prosperity *seven* times greater than the whole mass of a nation, who astonish us by the rapidity and extent of their general progress!

I could not, I own, resist the wish of showing, in this hasty sketch, the multifarious efforts of one single town, as well as the success which has attended it, and which may be said to have even turned the very reverses of fortune into a source of still more productive conquests.

There is certainly a wide difference between these bold and profound views, and the narrow policy of those inactive ports, where people imagine that by offering to strangers their wharfs and walls, free of duties of every kind, vessels will resort in crowds in places where commercial industry has not previously prepared outlets, commensurate with this eagerness and activity which actuate the importers. England affords us important lessons on commerce; she thus speaks to us by her example—" Do you wish that a port should obtain a long course of prosperity? Aggrandize, facilitate continental navigation on the whole territory that surrounds it. Let a Manchester, a Sheffield, a Birmingham, raise numberless factories, in the proximity of streams directed either by art or nature, towards the sea-port which it is your wish to render opulent and splendid. Then, new wants, the offspring of riches, will soon call for importations of all sorts. At the same time, your numerous produce, adapted to all tastes, suited to

all degrees of fortune, and brought, with little expense, to this maritime mart, will offer to the foreigner objects of exchange, as varied as advantageous. He will soon learn the road to such a market; he will himself use all his ingenuity to second your efforts, in order to multiply his advantages by augmenting your own; for such is always the reciprocity of the benefits which arise from commerce."

What are the works that have prepared and rendered so fruitful the germs of the astonishing prosperity of Liverpool? We have already explained that beautiful system of inland navigation, of which this port is the outlet, on the western side of England. It now remains for us to describe the works and buildings of the port and town*.

Early in the reign of Elizabeth, a mole was built in front of the town, and on the banks of the Mersey, under shelter of which vessels might winter in security.

In 1710, the first dock that England ever possessed for keeping ships afloat was begun; but it was indeed at Liverpool that the need of such an establishment must have been most sensibly felt. Bristol and London, being built inland, and on the banks of rivers having a muddy bottom, could keep afloat their vessels, and leave them exposed to the free

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* I twice visited the maritime works of Liverpool; in 1816, and in 1817. Mr. Forster, the able engineer who directed them, very obligingly furnished me with every intelligence respecting them.

course of the tides, and even allow them to lie aground at low water, without any fears for their safety. But Liverpool, situated as it is, almost at the very mouth of a large bay, open and exposed to violent gales, had not the same advantages. It was, therefore, necessary to have recourse to the useful invention of docks or basins closed by lock-gates.

Twenty years nearly elapsed before the completion of the first dock, called the *Old Dock* *.

From 1730 to 1760 one more dock only was added to this first: it received the name of the *Salt-house Dock* †, because it was excavated near a large building, in which salt, brought from the county of Chester, by the rivers Weaver and Mersey, was refined. (*See Plate.*)

Near these two docks, in which the water is always kept, a dry dock has been built, communicating with them, as well as with the Mersey. It serves as a passage from one of these docks to the other, without being obliged to go round by the

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* It is a parallelogram, though not regular, one of the sides breaking in considerably at right angles. The dock is 270 feet wide to the west, and 206 only to the east; its length is 200 yards; its superficies is 3½ acres. The gates, which are situated on the western side, are 32 feet wide, and 25 feet in height. The custom-house stands east, and on the smaller side of the basin.

† This dock is of a still more irregular form than the preceding. It is a quadrilateral figure, the sides of which are not even rectilineal. The whole range of its quay is 640 yards; its superficies is 4½ acres. Lastly, its gates are 34 feet wide, and 25 feet high.

river: it is also used to receive small coasting vessels, which, on account of their size, may lie aground at low water, without danger. These coasting vessels arrive from the north coast, laden with corn, provisions of every kind, coal, stone, *&c.* In return, they take back colonial commodities, as well as the produce of the Baltic, Portugal, and the Mediterranean.

George Dock, which lies to the north of these basins, was constructed in the reign of George II. It receives the vessels trading to the West Indies*. South of all these establishments lies the fourth dock in the order of the time of their building. This is *King's Dock*†, appropriated to the Greenland

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* It cost 21,000*l.* sterling. It is larger, and, at the same time, more regular, than the other two. Its length is 246 yards, and its breadth 100 yards; the whole range of its quays is 692 yards, and its superficies five acres. Lastly, its gates are 38 feet wide and 26 feet in height. This dock communicates by a lock with the dry dock, which leads from the two former docks to the Mersey. The ships, therefore, coming from the river, when once in this basin, may choose between the three floating docks, which stand in nearly the following directions:—The most ancient of all east; the second south; and the last north. Besides this, it is seen that in order to load and unload at the most convenient places, they can pass from one of these docks to the other without experiencing the inconvenience of going round through a part of the river. West of George-dock, a new esplanade is forming, which projects into the Mersey. A part of the old one has been taken, in order to enlarge the dock about 65 feet. When this work is completed, the total superficies of the dock will be 6¼ acres.

† The length of this dock is 272 yards, the breadth 136 yards; the whole range of the quays is 818 yards long; its superficies

ships; to those which import tobacco* from Virginia and other countries, *&c.*

Queen's Dock † is the fifth in the order of time, and communicates with the Mersey with the same basin as King's Dock. It is principally reserved for American vessels, and for ships coming from the Baltic.

Between the two latter docks and the three former, stands the *Duke of Bridgewater's Basin,* set apart for the boats which navigate the canal constructed by the Duke. The spacious and beautiful warehouse in which the cargoes of these boats are deposited, is between this basin and King's Dock. The basin and the dock communicate with each other by a canal which passes under a vault in the centre of the warehouses: under this vault are lock-gates, to intercept, at pleasure, these communications.

$7\frac{1}{2}$ acres. Its form is that of a regular rectangle: its gates are 42 feet wide and $25\frac{8}{12}$ feet high. A swing bridge, of cast iron, similar to those in the London Docks, serves for a passage over the canal, or entrance lock: this lock communicates with the Mersey by a basin.

* On the bank of the river, near King's Dock, spacious warehouses, of great beauty, have been lately built, to receive the imported tobaccos; they are capable of containing 12,000 casks of tobacco: in their enclosure are all the offices in which the business of the establishment is carried on. These warehouses, which are the property of the town, are let for a yearly rent of 5000*l.* On the northern quay of King's Dock are also tobacco warehouses.

† The lock-gates of Liverpool are each worked by four men, who, as a distinctive mark, wear an oil-skin hat, on which is

The five large old docks, without including the Bridgewater basin, and the two intermediary basins, have an extent of quays equal to 3600 yards; their superficies is twenty-eight acres. However, since the peace, it has been found that this vast extent was not equal to the increase of maritime commerce. Mr. John Rennie, having been consulted as to the best means of remedying this insufficiency, calculated first, that, from the summer of 1805 to the summer of 1808, there had always been, upon an average, 400 vessels afloat in the docks, and 300 sloops or flat boats in the dry basins, or on the basins of the Mersey. He proved, that in order to keep afloat, without incumbering each other, an equal number of vessels, the superficies of these basins ought to be more than doubled.

To attain this great object, and render the general system more regular, it was proposed to fill up the old dock, and on its site to erect a group of commercial buildings for the customs, the excise, the police, and the inspection of the docks. Thus, though one dock has been suppressed, the enlargement of the three old ones, and the construction of two new ones, the one north, and the other south of

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marked, in large yellow letters, the name of the dock to which they belong, and the Royal arms.

The locks of Liverpool have nothing essentially different from those of the Docks of Bristol and Liverpool; only the manner in which they are executed is more or less perfect, according as their construction is more or less recent.

the old ones, have caused in the docks of Liverpool an increase of sixty-two acres *.

From one dock to the other, on a level with their respective bottoms, there are subterranean canals constructed for the purpose of cleansing them; the stagnant water with which they are filled, necessarily depositing a considerable quantity of mud. When a dock is to be cleaned, the first thing done, is to open the lock-gates, in order that the water may run out at low water; afterwards, the sluices of the subterraneous canals with which it communicates are opened, and the water contained in these, running with great rapidity into the dry-dock, sweeps the mud away. At the same time, men provided with rakes, destroy the adherence of the mud, and make it follow the stream of the water-course. As soon as one dock is cleaned, it may serve to cleanse the others. It has been found sufficient to renew this operation

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* Each basin is under the direction of a *Dock-master*, who receives about 100*l*. per annum. He regulates the entrance and departure of ships; he fixes their respective places, either when they are simply to remain afloat, or when they are to load or unload: he is, as it were, the port-captain of the dock. All these Dock-masters, with the men who work the locks, and the night and day patrol, placed under their orders, receive a sum of 4968*l*. per annum.

Numerous precautions have been taken against fires. It is forbidden; first, to keep any gunpowder on these premises; secondly, to smoke, or to keep any combustibles, either upon the decks of vessels, or even on the quays; thirdly, to have any fires on board the ships in the docks, or any light, except such light be in a lantern.

every year, during twelve or fourteen successive days. This method, which has been long practised at Liverpool, is at once simple, ingenious and economical.

The more recent the construction of the maritime works of Liverpool is, the less wood is found in their composition, and consequently the more iron. Thus, for instance, the capstans used in opening and shutting the gates, the rollers that support the chains of these capstans, the foot-ways across the gates of the locks, the railing along the sides of these foot-ways, *&c.*; all these things, which were formerly of wood, are, in constructions of a more modern date, entirely of iron. The same remark holds good with the bridges which serve to establish a common carriage-way, over the canals at the entrance of different docks. The new bridges are of iron; but about the group of the old docks, bridges of wood are still found: the structure of the latter resembles that of the Dutch draw-bridges.

This progressive substitution of iron for most of the other materials used formerly in large buildings, is not the effect of any particular whim, or of a short-lived fashion; it is the necessary result of a comparison between the little cost of this material and the high price of wood, which in England, in particular, is excessive.

What particularly struck me, in the two visits I paid to Liverpool, were the works that were then in progress to enlarge Queen's Dock, and to excavate the new basins.

At the bottom of Queen's Dock, iron rail-ways were established

for carrying off the excavated earth. These rail-ways are formed of pieces which are only three feet in length, weighing about sixty pounds. These dimensions render them portable. It is therefore easy to lengthen or shorten the road, according to the direction in which the earth to be removed is to be conveyed.

The lower part of the walls of the docks is built of a sort of white stone, which is well preserved under water; the upper part is of granite, the grain of which is rough, and of a reddish hue. This granite is used in enormous blocks, not only in public works, but also in the construction of warehouses, and even private houses, the front of which, up to the first floor, is composed of stones of considerable size, dressed roughly (*à bossage.*) The effect produced by this style of building has something severe. It gives to edifices an appearance the more imposing, as the eye is, in some measure, narrowed and fatigued with the monotonous and gloomy look of the smoky brick-work which is to be met with in every part of England; one considers as gigantic, constructions, the materials of which exceed the common size.

The walls of the docks are not constructed in a sloping direction; their form is concave, and such as we have described in speaking of the London Docks. A little below the level of the lowest water-mark, the walls of the quays of the floating-docks, breaking in at right angle, form a sort of step, eight inches wide. Against the upper part of the wall, and above this break, wooden fences have been fixed, vertically; they are from twelve to fifteen inches square, and sufficiently close to one another to hinder the vessels from rubbing against the wall, and consequently from injuring it.

In 1817 the masonry of the new entrance of Queen's Dock, on the south side, was already completed. It has the form of an elliptical vault inverted; by this form it is better adapted to sustain the pressure of the earth, it more effectually resists filtration, and, finally, as it bears against the lower part of the lock-gates, it diminishes the pressure of the water, which these gates would otherwise have to resist entirely.

Near the new dock, on the northern side, I particularly noticed

a crane, put in motion by the action of the same steam-engine used to assist wagons, loaded with coals, in ascending a slope, near the water's edge. I will describe this crane with every possible care. (See plate.)

The projecting part of the crane is composed of two flat pieces, having each the form of a triangle, in part rectilinear, in part curvilinear. To make these pieces very light, they were cast with four open spaces, as large as possible; they are united at the top by an axle-tree, which bears a large metal wheel. The drag-chain passes over this wheel, and then descends along the back of the crane, where, at intervals, it is supported by rollers placed horizontally. The chain afterwards is rolled round a horizontal barrel, bearing a large cogged wheel, put in motion by a set of wheels, having sometimes a single, and at others a double power or purchase, according as the weight to be lifted requires more or less strength. The action of the steam is transmitted to the chain by which the weight is raised, in the following manner. It is communicated by a horizontal axis, concealed in a small passage, made in the masonry under ground, and advancing just below the stock of the crane; there, this axis bears an angular wheel. The part of the axis which traverses the wheel, being round, and not joined with it by any screw or pin, it may turn without imparting to it any movement. To communicate it, the following method has been adopted. A sort of iron *muff*, provided with two large prongs placed diametrically, presents at its centre a square eye, which exactly fits the square part of the axis, on which it may slide, till the two prongs engage with the spokes or radii of the wheel just mentioned—then they impart to the wheel the rotatory motion of the axis; this motion is communicated to a horizontal angular wheel, on which is a wheel also horizontal, but with parallel cogs, and which turns a second wheel of similar form. All this apparatus is immediately below the moveable platform upon which the foot of the crane rests.

The last-mentioned horizontal wheel has a vertical axis, which traverses the platform; and by means of another system of angular wheels it turns the horizontal axis, which would otherwise be

moved by a winch, if the crane were worked by hand. Two men are employed to make the crane and its platform turn round when it is necessary. To work the crane, when raising blocks of two tons weight, the following number of hands are necessary. First, one man to check or stop the movement of the chain. Secondly, two men to turn the crane whilst the block is rising. Thirdly, two men, engaged on board the ship unloading, in fastening the chains round the block. Fourthly, two masons stationed near the wagons to undo the chains.

It takes somewhat less than six minutes to raise a block, weighing from two tons to two tons and a half, to a height of sixteen feet, to fix the chain, to place the block on a wagon, to unfasten the chain, to restore the crane to its former position, to return the drag-chain, and put every thing in order to re-commence a new operation.

This handsome crane was cast in 1814, in the foundry of Messrs. Aydon and Elwell, at Sheff, near Bradford, in the county of York. I observed a machine of the same kind, worked by hand, supported by four iron rollers, which may be conveyed, by means of the rail-ways, to any part of this vast establishment, in which the blocks of stone necessary for the structure of the new dock are hewn. It is from the same foundery of Aydon and Elwell, and is marked 1817*.

When this crane, which can easily be drawn by two horses, is brought to the place where it is to be used, the first thing done is to adjust eight iron dice under eight vertical screws, regularly disposed round the platform on which the crane stands—then these screws are turned till they press against the dice and support the whole machine, instead of the wheels, which are then off the ground: the crane is then sufficiently stable to be worked.

Liverpool has also building-docks, which are called *graving-*

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* This crane weighs nine tons, and cost at the rate of twenty pounds sterling the ton.

docks, they are situated by the side of the dry-docks—there are three of them on the western side of the basin, which serves as a communication between the old docks and the Mersey. Two others, the most recently constructed, and the handsomest of all, are situated on the south of the basin which serves as a communication between King's Dock and Queen's dock*.

The quays both of the docks and basins are surrounded by warehouses: most of them are prodigiously high; some have twelve or thirteen stories. In general, in the centre of the front of the warehouses, a vertical range of door-ways is seen, which open upon each floor. Above the upper door-way is a small pediment which covers very strong pulleys, by means of which weights can be raised.

There are some warehouses, which have alternately one range of door-ways, and two of windows: such are those of the Duke of Bridgewater. Others have alternately one range of door-ways and one range of windows. I will now speak of the different machines, which appeared to me to merit the attention of the observer.

Near the custom and excise offices are seen small carriages,

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* The building-docks of Liverpool are of a very simple figure; their sides are parallel, and terminate in a semi-circle at the extremity opposite the entrance. They are 164 yards in length, and from seventy-two to seventy-eight feet wide; they are built of stone; the steps are about three feet high, the plane passing by their salient angles has an inclination of about sixty degrees.

In one of the docks down which I descended, there were four vessels successively one after the other. The new constructions, and vessels undergoing great repairs, are placed at the bottom of the dock, whilst small repairs are executed near the gates—such is the activity with which works of this nature are carried on in Liverpool, that a few days are sufficient for completing the thorough repairs of a ship.

Round these docks are the yards of the owners—those of the latest construction are enclosed with walls and palings, which reach to the edge of the entrance-quays.

mounted upon four iron wheels; the body, resembling that of an artillery wagon in shape, contains a set of weights. When they have to weigh goods, one of these carriages is conveyed either by hand, or drawn by one horse, to the part of the quays close to the vessel. A weighing-machine is likewise brought. Thus, cargoes, in the course of shipping or landing, are not moved one yard uselessly.

In the building-docks of Liverpool, I observed a species of timber-carriage of a very advantageous construction. It has one axle, two wheels, and two shafts. Above the axle is fixed, upon two vertical pieces of wood, a horizontal barrel, round which coils a chain, the loose end of which has two hooks, resembling those of a pair of pincers. When this carriage is to be used for conveying away a piece of timber from a pile, the driver forces these hooks into the end of the timber; he then whips his horse forward, and disengages the piece from the pile. Then, with a lever, he heaves at the barrel, which is held fast by a catch when he has to move his lever; in this manner, he raises the fore end of the piece: the other resting upon the ground, the mechanism of the truck has only the half of the weight to raise. This being finished, the driver conveys the timber to its destination. In naval arsenals, an apparatus like this would be essentially useful for the conveyance of large timbers, either straight or slightly bent, such as keel-pieces, stern-posts, ribs, beams, anchor-stems, *&c.* In civil architecture, this carriage might be used with no less advantage.

The English make use also of timber-carriages similar to ours. They employ them as we do, in conveying pieces of timber that are strongly nerved.

I have seen masts of very considerable length and bulk carried by two trucks, the one ahead, having its pole drawn by horses, and the other having its pole turned hindward; this pole serves as a rudder, and is worked by two men.

The very large wheels of English timber-carriages are strengthened by two flat and concentric circles, fixed upon the spokes, between the felloes and the centre. The planes of these wheels,

instead of being parallel to each other, are inclined; they approach towards the base, according to the general system of the English vehicles.

Monuments, Edifices, and Public Establishments.

In contemplating the maritime works executed at Liverpool, with a magnificence aiming only at the useful, and for the attainment of which no sacrifice has been spared, it will naturally be supposed, that this town has carried the same spirit into the conception and execution of its other public works and establishments, devoted to the common prosperity. In effect, the works and establishments we are about to describe, place Liverpool among the most important towns of Great Britain.

To the north of the Old Docks, we find a straight street, called *Pool-Lane**. Farther on, the public way enlarges; and we find, on the right, a large irregular square, in the centre of which is the church of St. George, remarkable for its architecture. But our whole attention is absorbed by the picture displayed before us. A magnificent street, widening as we advance, is terminated by the façade of the *Town-Hall*. This façade has first a sub-basement in freestone, with a range of arcades in a grave style, and without ornaments. The part above this is in the Corinthian order, formed of pilasters in pairs,

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* In effect, there was a pool in the place now occupied by the Old Docks. The name itself of Liverpool, is derived from *liver pool*. The *liver* is a water-fowl, strongly resembling the cormorant, which was formerly found in great abundance on the pool, on the site of which the dock was dug.

at the two wings, and of columns, equally in pairs, on the projecting part in the centre. High windows, rounded at the top, occupy the spaces between the columns. A pediment in the centre, and an attic with balustrades along the wings, crown the projecting part of this noble façade. The rest of the building is terminated by an attic, which is more simple, entirely massive, and decorated with *basso relievos*, which represent commercial allegories; these *basso relievos* are placed on the same vertical line with the arcades of the sub-basement, and the windows of the first floor. In the centre of the building, rises a dome, lighted by large lateral windows, surrounded by a colonnade of the Corinthian order, like the Pantheon at Paris; instead of a spire, this dome terminates in a statue, representing a female seated, and holding in her hand a lance surmounted by the emblem of liberty. This free and warlike female represents Great Britain.

The Town-Hall is entirely isolated. Its second front, which stands at the back of the façade just described, forms the southern side of a square, the other three sides of which are formed by the buildings of the Exchange. The same order of architecture reigns all around this square. A large portico serves the merchants as a place of meeting and shelter during the hours devoted to business. This portico is supported by a range of Corinthian columns and pilasters; the intervals are filled by windows, and the whole is terminated by an attic with balustrades.

The *Monument of Nelson* is erected in the centre of the handsome square of the Exchange. This monument is of marble and bronze, and cost above 9000*l.* On a circular pedestal of native marble, the English hero is seen trampling on a vanquished foe, who is expiring; an idea that seems to belong only to the most barbarous ages. Nelson holds out his sword to receive a last crown from the hands of Victory; at the same instant the figure of death is placing his withered hand on the heart of the Admiral, to indicate the fatal blow which this warrior received in his last combat. The figure of Nelson is naked, and by no means shown under the most dignified aspect. I cannot but acknowledge that these conceptions appear to me as strange, and in bad taste *; but they are perfectly worthy of the four naked figures of slaves, whom the artist has represented in chains, at the feet of the barbarian who caused the disarmed Admiral of a foreign nation to be hanged at the yard-arm of his ship! Is it by such emblems as these that England would wish to make posterity believe that the only thing she taught the vanquished to feel was spoliation and slavery? Strange eulogium for a conqueror! When Louis XIV., inebriated by his triumphs, permitted his statue, in the act of trampling under feet the van-

* The justice of these reproaches is obvious; but it is a consolation that London has not been suffered to be deformed by allegories from the same school.—*Translator.*

quished nations in chains, to be erected by a courtier, on the *Place des Victoires*, he may, doubtless, have applauded this conception of *the Great Age*, but he did not foresee the tardy vengeance of outraged nations!

But let us turn our eyes to those monuments which do honour to man. The inhabitants of Liverpool have prepared for the poor, the orphans, the blind, and the sick, buildings, at once spacious and commodious, and kept with that neatness and cleanliness so well calculated to soothe the mind of suffering man, in offering him the prospect of those cares and succours which tend to restore health, and of that comfort which makes him bear more patiently those infirmities which it is beyond the reach of art to remedy.

The public *Infirmary* is situated on an elevated and healthy spot. Extensive court-yards and fine porticoes afford the convalescents a free space* to recover their strength in the open air or under shelter, according as the weather is favourable or otherwise †. The wards contain about two hundred

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* This building was completed in 1748. Its façade is 120 yards in length; the total superficies of the establishment is 2272 square yards. Vent-holes in the exterior walls, on the level of the ground of the corridors, and in the corridors themselves, near the floor, admit currents of air whenever it is thought proper. Wooden stoppers serve to close these vent-holes during the night, and even in the day, when the cold is too great, or the wind too strong.

† I observed a pump, with an apparatus of such a kind as to allow a great many men to move it, without obliging any one in-

beds, and receive every year from twelve to fifteen hundred sick. The funds necessary for the support of this establishment are formed by the voluntary subscriptions of the generous and the humane. A subscriber paying two guineas has a right to recommend one poor sufferer. The sick of all the parishes of the town are admitted, without any restriction, and, what is rare in England, *where every town has its own poor, and none but them*, the sick, though not belonging to any of these parishes, are equally admitted.

The *Hospital for Seamen*, situated in the same group of buildings with the Public Infirmary, is set apart for disabled seamen belonging to Liverpool, as well as for their widows and orphans. A botanical garden, contiguous to the two establishments, serves for the instruction of young medical students, and provides the public Infirmary with simples.

The *Lunatic Asylum*, and the two last-mentioned establishments, which stand near it, are under the superintendence of the same physician, Dr. Barrow, who, for a long time had subdued the fatal effects of an intermitting hospital fever, which had resisted all efforts before his time. By his enlightened cares and indefatigable zeal, he facilitated the cure of this

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dividual to make any great effort. The working of this apparatus serves, at the same time, for exercise and recreation to the convalescents, and supplies nearly the whole of the water necessary for the establishment.

contagious disorder; nevertheless, he at last himself fell a victim to the typhus fever, which he had so many years combated with success. He was living when I visited Liverpool, and it was to his kindness I was indebted for the knowledge of the most important details of the beneficent institutions of this town, their actual advantages, and the most remarkable improvements that had been made by them. May these few lines, at least, be sacred to the memory of his many and rare virtues!

In the lunatic asylum the patients are treated with great kindness and gentleness; all those whose dispositions are found to harmonize are kept together; only the violent are kept separate, and every care is taken to soften the painful feeling of seclusion.

The *Dispensary* is another establishment well worthy of admiration—it is supported by 500 subscribers, who jointly pay, every year, 700*l.* sterling; and also by donations, legacies, *&c.* It affords succour to more than 10,000 persons annually. The physicians and surgeons who attend it give their services gratuitously; medicines are also made up and distributed gratis to the needy and afflicted. When a poor person has not the power to come himself, one of the subscribers to the establishment gives in his name and address, and he is visited at his own house and furnished with such succours as his situation requires.

In 1775 the *Humane Society* was established, for the purpose of restoring to life drowned persons,

taken out of the water—they give a reward of a guinea for every person drawn out living, and half a guinea for those drawn out dead. The society causes long poles provided with hooks to be distributed about the docks, in order that means may be everywhere at hand to save those who may fall into the docks.

An association which appears to me to merit particular attention, is the *Strangers' Friend*—its foundation is due to the Methodists, a new sect, whose increase throughout Great Britain is prodigious, and which, joined to other dissenters, will soon reduce the Church of England, in its turn, to be only the sect of the privileged minority *. Whatever be the religion or country of the unfortunate, it is sufficient that they are found in distress; when a stranger begs for assistance, the society, without any other inquiries, than as to the attestation of his being really an object of distress, comes to his aid with money, if he wants the means of subsistence; with clothes, if he is suffering from nakedness. It would, doubtless, be imagined that an institution every way worthy of the disciples of a Penn or a Socrates, was the work of a faith whose toleration would afford the very model of gentle and amiable philosophy. On the contrary, the Methodists pronounce anathema and *eternal* damnation against

* Mr. Dupin may be mistaken in this as in others of the speculations which do not belong to his subject.—*Translator.*

all those who do not adopt, without restriction, the specific minutiæ of their mode of belief, whose date is but of yesterday! But the competition of sects is like every other competition; by its means egotism is induced to unwrap her mantle, and make an effort for the general good, in order to obtain the favour and preference of the public.

The *House of Recovery* is devoted for the reception of persons afflicted with fevers, whose disorder, for want of necessary care and attention might become fatal to the patients, and contagious to their neighbours. In a town built upon a marshy soil, and though paved, still very muddy in its old quarters, which present many very narrow streets, at once extremely foul and very thickly peopled, that must be an useful institution which strives to prevent epidemic disorders, by taking under its care the individuals who might foment the germ of the evil. We must not forget the alms-houses and the institution of the ladies of charity, whose object is to succour lying-in women.

When George III. attained the fiftieth year of his reign, he had for some time been deprived of his reason*, and might be said to live only in the memory of his subjects by the recollection of his popular virtues. Nevertheless, throughout the greater part

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* Incorrect in date. George III. was publicly exercising the regal functions at this period. His last long illness began a few months afterwards.—*Translator.*

of the principal towns of the empire the grateful citizens celebrated the jubilee of this monarch, and celebrated it worthily, by useful and benevolent institutions. Let us pause for a moment on those of Liverpool—we will point out, in the first place, the society formed for ameliorating the condition and comfort of the poor. It is by inculcating lessons of prudence, and rewarding industry, that this institution benefits the indigent classes of society. It offers rewards for meritorious conduct—it makes it a principal object to teach the necessitous those economical plans and practices which supply the place of riches ; and, above all, to make them contract those habits which are the offspring of these practices, and which inspire that love of order and of moderation, which also supplies the place of affluence.

It was also to celebrate the jubilee of George III. that the Magdalen Asylum was founded, for the benefit of those unfortunate women whom weakness and distress have led astray from the virtues of their sex. Lastly, the same epoch, and the same intentions, gave birth to a society who proposed the formation of a fund for the deliverance, or at least for alleviating the condition, of persons imprisoned for debt, and whom misfortunes alone have plunged into distress.

The same humanity which prompts the benevolent to relieve poor debtors, has also made them seek to render the abode of a prison less painful. I

may also mention the *House of Correction*, as a model in its kind ; it is not less remarkable for its regulations than for its structure and arrangements. It is built in the form of a half circle, prolonged by two right lines, after the manner of the ancient theatres ; the entrance is in the centre of a front wall which joins the two extremities of this kind of horse-shoe. The porters and turnkeys are lodged under the portico right and left of the entrance.

A building which contains the chapel of the prison and the apartments of the keeper, stands in the centre of the semi-circle formed by six towers or pavilions, placed at equal distance from each other. Each of these towers is two stories high, terminated by a terrace, on which is a reservoir of water, the contents of which could be thrown upon any part of the building that might happen to take fire. The towers are perfectly similar ; they all front the keeper's house, and are united by iron rails, both within and without the half circle which they form. The court yards formed by these rails are divided into two equal parts by other railings directed from the centre to the circumference.

To the height of the first story, bridges of cast-iron are thrown from one tower to the other, and from the central building to all the towers. These bridges are paved with large stone slabs, and guarded by iron balustrades. By these means of communication, the keeper, and those under him, may pass, in a moment, from the central building

to all parts of the establishment, without descending the stairs, or crossing any court yard.

The enclosure wall stands at a little distance from the towers, which it surrounds in the form of a half circle. Thus the keepers may circulate round the space occupied by the towers, and the railings which connect them.

On entering the prison, after crossing the portico which contains the apartments of the porter and turnkeys, we see on the right and left neat spots of garden cultivated by the keeper. We find gravelled walks, court-yards covered with turf, and regular buildings similar in structure, disposed with symmetry and joined by airy arches. Nothing here gives the idea of punishment and suffering; it is the involuntary, but, at the same time, the embellished residence of men who in an evil hour have turned from the paths of rectitude. Happy is that nation where the liberty of the individual is so highly valued, that society should think it necessary to offer such amends to the culprits whom it is obliged to keep prisoners, in order to ensure the peace and happiness of those citizens who remain faithful to the laws!

Establishments of Literature and of Public Instruction.

We must not, in Liverpool, seek for those flourishing universities and celebrated academies, which are the hope and the glory of the sciences, letters, and arts. Liverpool is what a great commercial town

must necessarily be; it is a town whose entire existence is directed towards one practical end; there every thing calls men to riches, to respect, by the common ways of a life devoted to labour and commerce. The man born for the sciences here turns his genius towards the construction of machines, towards the direction of public works, or the erection of edifices more properly adapted to the purposes of commerce.

The man whom literature would mark for its own is also drawn along by the vortex by which he is surrounded; if he makes efforts to sacrifice to the muses, he cultivates them by stealth, and follows, with the rest, the great and seductive career of fortune. It is thus that the celebrated Roscoe found his principal occupation in an important banking concern, reserving only his leisure hours for the composition of the lives of the two Medici and Leo the Tenth*.

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* It must be acknowledged, to the glory of Roscoe, the Ginguené of England, that his works do not betray anything like hurry, and have nothing superficial. It is remarkable that the most distinguished productions upon the history of Italian literature are the works of an Englishman and a Frenchman, men not less pre-eminent in their knowledge, than in the integrity of their public and private character. In the visit which I paid to Mr. Roscoe at Liverpool, I could not but feel a sentiment of interest and respect, in beholding an old man of sixty, whose head was covered with the grey hairs of age and of misfortune, but walking uprightly, without losing any thing of his imposing stature, with the physiognomy of a Grecian sage, simple, noble, and benevolent; yet, in spite of the serenity which seemed painted upon his countenance, he was not a

A short time since, a number of subscribers united for the purpose of founding an Academic Institution, in which the professors are to give instruction in the most useful sciences. The organization of this establishment resembles that of the Royal Institution of London, which itself is modelled, both as to its forms and essence, on the ancient *Lycée* of Paris. The opening of the course of Lectures took place the 13th of November, 1817. On this occasion the views of its founders were explained to the public, in an excellent discourse pronounced by Mr. Roscoe.

A body of subscribers have also formed a botanical garden, not only to contribute to the instruction of medical students, but also to promote the knowledge of practical gardening and agriculture.

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happy man. The vicissitudes of war and peace had given a blow to his fortune—to honour his engagements he had already sold his library, and, when I saw his pictures, the workmen were ticketing them according to the catalogue of their approaching sale. The books which Roscoe regretted the most formed a collection of about 300 Italian works, remarkable for their intrinsic value, and the rarity of the editions. Mr. William Rathbone, a merchant of Liverpool, bought them all, and, as a homage to the author of the Lives of the Medici and of Leo X., hastened to restore them to their former possessor. The latter would not accept them but on condition that they should immediately be made over as a legacy to the library of the Athenæum, a literary establishment, which is distinguished for the admirable selection of works which the public find there. The foundation of this institution is, in a great measure, due to the zeal of Mr. Roscoe.

It is to the enlightened zeal of Mr. Roscoe that this establishment is also due.

The simple and rapid mode of education adopted in the schools of Bell and Lancaster is perfectly suited to the people of great commercial cities. I visited, at Liverpool, a school of this kind, established in a building of very extensive dimensions. I saw children, from eight to ten years of age, perform, without a fault, very complicated sums in multiplication and division. Let us hope that schools of this kind, where instruction is so rapid, and youth so accustomed to order, to obedience, and to the habit of reflection, will be more and more propagated in our own beautiful France. On her soil, fertile in mind and talent, as on the fruitful plains of India and Egypt, let the earth be stirred but ever so slightly, and we should see those germs burst forth, that would soon yield abundant and fruitful harvests. Alas! since the period at which I entertained this hope, so flattering to the heart of a good citizen, deplorable prejudices have repulsed with outrage and by every means in their power, one of the most sure and certain methods of securing to Frenchmen the superiority of light and knowledge,—a superiority which alone can maintain them in the first rank among civilized nations.

Liverpool has the glory of having been the first in England to found a great school for the education of the blind. They are taught to make tissues of

every kind, works in straw, *&c.* The girls, who are separated from the boys, learn those kinds of work that are best suited to their sex. A part of them receive lessons in vocal and instrumental music, to solace their loss in moments of relaxation, and thus to compensate, as it were, the deprivation of that sense which is the most active, and, in some degree, the most physical of all others, by the enjoyments of that sense which speaks the most forcibly to the soul. They have a chapel, with an excellent organ. During the religious ceremonies, the two sexes form separate choirs, and sing alternately or together. Their voices, accompanied by the most majestic of instruments, give to the simple and touching music of the English church a charm still more affecting. The blind are all cheerfulness during the hours of work; in the midst of their habitual occupations, a lively conversation serves to make the hours glide pleasantly away. Can they feel the necessity of any efforts of attention? As theirs cannot be taken by the view of any external object, they arrive at results, to which those whose eyes are open to the light, but who are not endowed with a higher degree of intellect, would not attain.

The school of *Female Industry* is admirable in its kind. Poor girls are taught to read, write, knit, sew, spin, *&c.* When they excel, either in their work or good conduct, they are rewarded by distinctions, and by little functions which keep them some years in the establishment. A modest marriage-

portion is laid by from the fruits of their economy, which is given them when they marry; afterwards they receive a gift of two guineas at every lying-in.

A handsome building, four stories high, employed for lodging, instructing, and employing the poor, is called *The House of Industry*. Two floors are set apart for spinning, as well as other manual labours. The refectory can receive four hundred persons to take their meal. Behind the principal building, two great detached wings contain twenty-four suites of apartments, having each three rooms, every one of which can accommodate eight persons.

The Blue-coat Hospital takes its name from the blue jacket which is the uniform of the children of this school. In 1709, the epoch of the first increase of Liverpool, a number of subscribers founded an establishment for the education of forty boys and ten girls, providing them with clothing, but without feeding or lodging them. Since 1714, the children were also found the two latter, at the expense of the establishment, which has since been enlarged from time to time: at present it reckons 280 boys and 50 girls. Both sexes are taught to read, write, and cast accounts, according to the system of Dr. Bell. Navigation is taught to those boys who manifest an inclination that way. The girls are taught to spin, to knit, and also the art of *house-keeping*. Children are admitted at the age of eight; they go out at fourteen, to be apprenticed to such businesses as they appear to like.

At Liverpool, as in all the other towns of England and Scotland, there are *Sunday schools*, so called, because they are held on those days only. In these, young apprentices are gratuitously instructed, who are employed during the rest of the week in manual labours. Cannot an institution, so admirable, be introduced into France, in country places especially, where the village priests would be able to add this moral service to the many other blessings which they diffuse around them, in modest obscurity, and in the spirit of pure disinterestedness? According to the methods of Bell and Lancaster, a single pastor might instruct all his young parishioners, without fatigue; and in a short space of time, he might even, according to the one or the other of these methods, teach them the precepts of the Christian doctrine, at the period of their taking sacrament for the first time.

All these details are minute, and will, doubtless, raise a smile of pity or disdain, in many a free-thinker. But I feel persuaded, after the lessons of experience which England offers us, that without allowing ourselves to be carried away by religious dissensions, instruction, morality, and the love of the Divinity, ought to be inculcated with indefatigable zeal among all classes of society, from the highest to the lowest, to raise mankind to its highest destinies; and to endue the mind with that solidity and *consistency*, which alone ensure the stability of politi-

cal institutions, together with the durability of public and private happiness.

At Liverpool, an auxiliary Bible Society seconds the efforts of the central society in London: it distributes Bibles and Testaments, gratis, to sailors and workmen. These sacred volumes are printed in all languages, for the strangers of all the different maritime nations who resort to one of the greatest ports in the universe.

Literary Establishments.—For some years past associations have been formed in many of the towns of Great Britain, for founding libraries, belonging exclusively to subscribers, with reading-rooms, where the most interesting journals, literary and political, both of England and of other countries, are to be found. These rooms are generally provided with excellent maps, which assist in explaining certain passages of the newspapers, or illustrate the details of great commercial transactions.

On entering these news-rooms, I have often seen from forty to fifty persons seated round tables, covered with newspapers. There must necessarily be a continual movement in a room of resort for persons mostly men of business, who alternately come in and out; yet no noise was heard, sufficient to disturb the readers: sometimes persons are heard whispering in a low tone of voice, but so as not to disturb their neighbours; but in general an absolute silence prevails. This recollection, which leaves a

man with his thoughts, accustoms him to concentrate his attention, and produces a maturity of judgment, which is rarely found in those volatile beings who are always talking with others, because they never know how to talk, or rather to commune with themselves.

Liverpool has three great institutions of this kind, the Athenæum, the Lyceum, and the Union rooms.

The building of the Athenæum, which was erected expressly for this purpose, cost above 4000*l.* It belongs to five hundred proprietors, who each pay two guineas per annum. This sum is devoted to keeping the establishment in good order, to the expense of fires and lights, the payment of servants, *&c.*, and, in fine, to the purchase of the most generally useful works. In the course of fourteen years, eight thousand volumes have been collected, which are intrusted to the care of a librarian, paid by the institution. There are also private reading-rooms attached to the library. The different journals and periodical works are scattered about the tables, in a hall, the superficies of which is not less than 222 yards square.

The *Lyceum* is the re-union of two societies, who divide the expenses of the building between them, but are distinct with regard to the room for newspapers, as well as for the library, which already possesses more than ten thousand volumes. In 1807, the news-room had 800 subscribers, and the library, 893. I request the reader to notice this

difference, in a country, where, if possible, the rage for news is stronger than even in France*.

The *Union* has also a news-room and a library, as poor as it is neglected. It was built in 1800, an epoch when the memorable bill was passed for the union of Great Britain and Ireland, which then took the title of the United Kingdom, and were subjected to the legislative power of one *imperial* parliament. This is an event to which Frenchmen have paid little or no attention, but which, however, will have the greatest influence upon the power and prosperity of the British people.

Besides the three establishments we have just described, four others are devoted to the reading of the public journals, and to the meeting of men of business: 1st, the *Chamber of Commerce*; 2nd, the *Eclectic Room*; 3rd, the *News Room*, one of the largest and handsomest in England. It is 100 feet long, by fifty broad; it is on the ground floor of the Exchange. Immediately above, is, 4thly, the Chamber of Insurance, established upon the plan of the famous institution of the same kind, belonging to Lloyd's in London.

Chester. On quitting Liverpool, and re-ascending

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* As a third of the subscribers is composed of ladies, a third of the library is made up of novels, plays, &c. I point out this fact to the future apologist of the French ladies, when morose Englishmen accuse them of being more frivolous than their own countrywomen.

the Mersey, by following the Chester canal we may reach this city; and such is the road we followed, in describing the canals of the centre of England. (*See Vol.* I.) But we may arrive at the same point by descending the Mersey, and skirting a long and narrow tongue of land, which separates the mouth of this river from that of the Dee; the mouth of the latter is still more difficult to clear than the former, on account of the bar which obstructs it. The navigation of the Dee presented great natural obstacles; but its bed has been much improved, by confining it between strong embankments of more than ten miles in length. At present, vessels of 300 tons burden may come as high as Chester*, which is the limit of the sea and river navigation.

Chester, the capital of the county of that name, reckons 19,949 inhabitants, and sixty-two ships, measuring 4071 tons. It was formerly one of the richest mercantile ports, on the western side of England. Chester had a very active commerce, particularly with Ireland, the linen and other produce of which were received in exchange for those articles of English produce which were wanting in

* Vessels cannot go higher than the bridge thrown over this river. This bridge, which is very ancient and irregular, is obstructed by mills near the right bank; while a weir, on the other side of the bridge, stops up the arches near the left bank.

Ireland. The greater part of this traffic is now transferred to Liverpool.

Chester stands upon an eminence, in the centre of a country remarkable for its beauty. Towards the south, the Dee surrounds its ancient ramparts. On the other side of this river, is a range of hills, rising in the form of an amphitheatre, till they reach the highest among the mountains of Wales. In this immense picture, a vegetation of the richest and most varied kind, adds a grace to the majesty of the scene.

Its very name of Chester (*castrum*) bespeaks it to have been a Roman military station. The two principal streets, which cross at right angles on the summit of the hill on which the city is built, were the principal roads of the ancient camp. They were cut out of the hill, composed of a soft stone, and are as if cased in on their whole length. On the ground floor is a range of shops; above, an open portico, itself surmounted by one or two stories. On the level of the portico, the story which is the first in the principal streets forms the ground-floor on the back. The whole of this architecture is more extraordinary than pleasing; the shops are wretched, the porticoes low, irregular, and supported by rude and massy pillars. One would think to be visiting a town of the twelfth century. If the British towns, founded by the Romans, resembled this, it must be acknowledged that they

differed very considerably from the elegant cities of Herculaneum and Pompeii, which are models of good taste and magnificence.

The suburbs of Chester are larger than the town itself, and, above all, are much better built. In one of these suburbs, on the banks of the canal which runs to Nantwich, is a rich manufacture of white-lead, lead, shot, *&c.* There is, in this manufactory, a tower above 100 feet in height; from the summit of this tower, the melted lead which is to be converted into shot is made to drop into a receiver filled with water. The principal branch of industry in Chester is the manufacture of gloves.

The castle of this town, which commands the Dee, was formerly very strong; its building dates from William the Conqueror. This castle, and the walls flanked with towers, with which Chester is surrounded, are, like the fortifications of Carlisle, very perfect monuments of the military architecture of the middle age; but I confess, that the fortifications of Avignon strike me as being much handsomer than these.

The most remarkable building in Chester is the Sessions-House and the County Prison, united into one group of buildings. Within the walls of the castle, is a very spacious terrace, on one side of which is a long portico of columns of the Doric order. It is open in the middle, and leads into a large rectangular court: in this part of the portico, it breaks in, and present four rows of columns of

four each. To the right and left of the court are two isolated wings of equal dimensions, and built upon the same plan, having a ground floor and one story; the windows are separated by pilasters of the Ionic order, of the same height as the building. In one of the wings are the barracks, and in the other is a depôt of arms. At the bottom of the great court, opposite to the entry, is the principal building. In the centre of the façade is a portico of six columns, in front of the Justice-hall. This hall is of a semi-circular form, and provided with rows of seats, rising in the form of an amphitheatre; it is surmounted by a dome.

On the right and left of the portico, two wings of similar form, built of free-stone, roughly cut (*en bossage*,) show, by the severity of their architecture, that the building is not destined solely for judicial solemnities; but also for the confinement of the prisoners. The interior is still more worthy of observation. In its arrangement, the philanthropic ideas of the celebrated Bentham have been followed, by constructing the prison in the *panoptic* form, because by this means, the keeper, from the windows of his apartment, can, at one glance, look over the whole of the establishment. The building which contains the prisoners' cells, is in the form of a semi-circle; it is divided into six equal parts, between which are gardens. These divisions enable the governors to separate the prisoners, according to the nature of their offences. A list, con-

taining the names of the prisoners, and the offences for which they were committed, is suspended from the balcony of the keeper's apartment. When prisoners are to be put upon their trial, they are brought to the bar of the hall by a subterraneous passage.

The prison of Chester affords the best possible proof, that the English are not, as has been asserted, incapable of forming the noblest conceptions of architecture. Mr. Harrison, of Chester, furnished the plans of this splendid building, which, by its admirable arrangement and noble simplicity, does honour to the genius of the arts. Lastly, this building cost nothing, either to the revenue, or to individuals; it was built from the extra returns of the Chester and Nantwich canal. Thus, the same means which tended to the increase of industry and of opulence, has also served the ends of justice and consoled humanity.

CHAPTER III.

Western Coast of Wales.

In comparing Wales with England, we discover physical differences, no less striking, than those existing between its resources of industry, and its social state. The manners preserved by the inhabitants of the mountainous districts, have a distinct and very remarkable character. They still speak the Gaëlic idiom; they still preserve their national music. The harp, which gave renown to their bards, and animated the courage of their warriors, still continues a popular instrument; and, even now, it holds a conspicuous place by the side of the leopards, in the arms of the British empire.

Our present object is limited to the consideration of the physical character of this country, and the works of art undertaken to facilitate the industry and commerce of this province. Wales is divided into a number of counties; the following are those on the western coast:—

Counties.	Population.	Square miles.	Inhab. per sq. mile.
Flint	54,900	242	226
Denbigh	78,000	633	123
Caernarvon	59,100	544	109
Anglesea	46,000	271	170
Merioneth	35,100	663	92
Cardigan	59,000	674	87
Pembroke (½)	37,750	304	124
Total	369,850	3331	133

Descending the western bank of the Dee, to pursue our journey along the coast of England, we first coast the county of Flint, which is rich in mines of coal and lead. The little town of Flint, which gives its name to the county, must be noticed for the coal-mines in its neighbourhood, and for an ancient castle, flanked by three polygonal towers; it formerly served to protect an anchorage on the Dee.

We pass before the town of *Holywell*, which derives its name from a celebrated well, the mineral waters of which are very salubrious, and which superstition for a long time had held sacred. Some considerable cotton-manufactures and mines, from which copper, lead, and calamine are extracted, have, within these few years, very much contributed to the prosperity of Holywell, which, at the present time, reckons 8309 inhabitants.

Pursuing our course, we double the mouth of the Clwyd, a river, upon the banks of which is situated the small city of St. Asaph, celebrated for its ancient cathedral.

Beyond the Clwyd begins the county of Denbigh, rich in lead mines, and famed for its manufactures of flannel, gloves, and shoes; agriculture, also, has very lately, made considerable progress in this county.

We find no remarkable port upon the coast of Denbigh, which terminates, in the west, by the peninsula and cape of Great Ormes, at the mouth of

the Conway. This river separates the counties of Denbigh and Caernarvon; it has also some copper-mines.

One of the principal roads leading from London to Dublin passes through Chester, Holywell, and St. Asaph, runs along the coast of the county of Denbigh, and crosses the Conway at *Aberconway*, a small town, the port of which is excellent. Mr. Telford has proposed throwing over the Conway, opposite this town, a bridge of five arches, the three smaller of which are to be of stone, the fourth, equally small, of iron; and, lastly, a fifth, of cast-iron, which is to have a span of 200 feet. The latter is to be constructed according to the principles of that represented in the plate. The expense of the bridge and its access is estimated at 28,466*l*. sterling.

From Aberconway the road coasts along the shores of an extensive bay, till it reaches *Bangor*, a town of 3579 inhabitants. We must notice, in this small town, a school endowed with 400*l*. per annum, for the education of poor children.

At Bangor, commences the channel or strait of *Menai*, which forms the separation between Wales and the Isle of Anglesea; it opens in the south-west, a little below Caernarvon, a town celebrated for its salubrious situation, and which is much frequented during the summer season for the sake of sea bathing. A considerable trade is carried on in the port of Caernarvon; the exportation of slates

only, which are excavated in this county, exceeds a yearly return of 50,000*l.* sterling. These slates are brought, by a very economical plan, upon iron rail-ways to the place where they are shipped.

The southern roads of Wales, which converge upon Caernarvon, are prolonged parallel to the Menai Strait, as far as Bangor, where the two main roads from London to Dublin unite. Mr. Telford is at the present moment engaged in the construction of an iron chain-bridge, by which this strait will be crossed, opposite Bangor; it is an undertaking of importance, for the accomplishment of which the projector has frequently altered his plans. We will wait for the final completion of this work before we attempt a description of it.

The *Isle of Anglesea* is remarkable for its sterility, its nakedness, the barren rocks and the stony soil which it presents on every side; but it possesses rich copper mines. It contains the port of Beaumaris, in which 515 vessels are registered, measuring 24,880 tons, though Beaumaris itself has but 2205 inhabitants.

The *Port of Holyhead*, which is still more important, is situated on a small island, west of Anglesea, on the most direct way from London to Dublin*. It

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* The passage from Holyhead to the latter port is generally accomplished in one night, by packet-boats, which are well manned and well fitted. They are at present constructed according to the excellent system of Sir Robert Seppings.

stands at the entrance of St. George's Channel, which forms the separation between England and Ireland; it seems placed there by the hand of nature herself, as a shelter for vessels coming north or south, and unable to run out at sea through contrary winds; hundreds of vessels are seen in its anchorage, detained on this account, and which are all observed getting under weigh at the same moment, when the wind changes in their favour.

Much has been done, and much is still doing to add, by works of art, to the natural advantages of Holyhead. They are constructing in front of the port, to protect it from the violence of the surf, a mole, which will be 1300 yards in length, and of which the base is ninety yards in breadth. The slope of the side towards the sea is in the ratio of 5 : 1; the breadth at the summit is eight feet; at eight feet below the summit, is a way forty-eight feet broad, serving as a quay. Towards the head of the mole, the quay rises forty-seven feet above the level of low-water mark, and six feet above the highwater. The mole and all the great works of Holyhead are executed in granite. Towards the head of the mole, a little inside, it is intended to erect a spur of a square form, forming a saliant of sixty feet, and having 164 feet in width; it will render the sea in the port still more quiet.

Independently of the great entrance of Holyhead, there is another towards the south, in front of the mole, but it is so narrow, that no use is made of it, except at those times when it is impossible to enter or go out by the other.

A project is on foot to form and surround, by stone quays, a wet dock, the superficies of which will be $22\frac{1}{2}$ acres, with a depth of the water of $19\frac{2}{3}$. A light-house has been built upon the rocks, south of Holyhead; a second is also to be erected on the head of the mole.

Such works as are executed, at this port, under water, are effected by means of a diving bell, according to the method described, and of which a plan has been given, in *The Naval Power, &c.* Vol. II.

If we return to Caernarvon, to continue our course along the coast of Wales, towards the south-west, we find no port of any consequence, this side the promontory of Broichy-Swil. There, after turning to the east, we pass before the road of Aberdaron, and the gulf of Hell's-mouth. The coast of Caernarvon takes a turn towards the north-east, as far as the limits of Merioneth, a county in which the population, when compared with the territory, is the least considerable of the whole. This circumstance is to be attributed to the sterility of this singularly mountainous district. The pasturage found in the valleys, and on the secondary hills, form its principal agricultural riches. But it is not without the resources of industry. There are manufactures of coarse stuffs, flannels, kerseymere, stockings, and Welch wigs.

On the coast of *Merioneth* stands Harlech Fort, which protects a very good anchorage. At Barmouth we cross the mouth of the Avon, which passes at Dolgelly, the principal town of the county, which, however, has but 3588 inhabitants.

Advancing towards the south, we double Towin, a watering-place, and afterwards the mouth of the Dulas, which rises in Montgomeryshire. This county almost wholly belongs to the *basin* of the Severn.

At the mouth of the Rhediot, we come to the port of Aberystwith, in which are registered 156 ships, measuring 9169 tons. This port, which is in the neighbourhood of some very productive lead-mines, forms a part of the county of Cardigan, the riches of which consist almost entirely in flocks and minerals.

Cardigan, the capital of this county, has but 2397 inhabitants: it reckons 53 ships, measuring 3028 tons: it is situated nearly at the mouth of the Tyvy, which forms the separation between the county of Cardigan and those of Caermarthen and Pembroke*.

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* There is a high road from Aberystwith to Cardigan, which passes the Tyvy over a stone bridge, and afterwards divides, and runs through the principal parts of the county of Pembroke.

CHAPTER IV.

Basin of the Severn, Bristol Channel.

We comprehend in this chapter, not only the banks of the Severn, but also the spacious gulf, called the Bristol Channel; from the most western cape of Wales to the south-west promontory, which terminates Great Britain, at the extremity of the county of Cornwall, and which, for this reason, is called the *Land's End.* The following are the statistic data of this vast *basin:*

Counties.	Inhabitants.	Square miles.	Pop. per sq. mile.
Pembroke	37,750	305	123
Caermarthen	92,000	974	97
Brecon	44,500	754	59
Glamorgan	103,800	792	131
Monmouth	72,300	459	158
Hereford	105,300	860	122
Radnor	23,500	426	55
Shropshire	210,300	1341	157
Montgomery	61,100	1070	57
Worcester	188,200	729	244
Warwick	280,000	902	310
Gloucester	342,600	1251	273
Wilts (½)	113,300	689	164
Somerset	362,500	1642	221
Devon (½)	223,950	1289	173
Cornwall (½)	131,300	663	198
Total	2,392,400	14,146	160

Every thing along the shores of the Bristol Channel tends to give a great activity to the shipping. There the three reigns of nature pour out their riches and their fecundity. The counties of Somerset and Gloucester shine conspicuously by their agricultural produce. In the counties of Cornwall, Devon, Monmouth, Glamorgan, *&c.*, the mineral kingdom presents to industry the most abundant resources, and to commerce the most important means of exchange. Cornwall is celebrated for its mines of copper and tin, as well as for its fine potteries and productive slate quarries. The opposite coast of Wales abounds in coal, iron-mines, and chalk-quarries. Hence, the products of the latter country are employed in procuring and preparing those of the former; thus, a great commercial intercourse is carried on between their establishments of industry. Finally, we may add, that the Severn, from the vast extent of its course, through counties differing most essentially by the nature of the soil and of the mines, as well as by their manufactures, affords every facility to an immense inland commerce.

After doubling Cape David, in the county of Pembroke, we enter St. Bride's Bay—it has the form of a semicircle, open on the western side, and prolonged southwards by some small islands. Having passed these, we sail eastward, and soon reach *Mil ford-haven*, surrounded by lofty mountains; it is sinuous, and penetrates far inland, and has a sufficient depth of water to receive the largest men-of-

war. It will be a place of high importance, whenever Great Britain engages in any future war with America, and in all circumstances under which Ireland may require to be watched with active and powerful vigilance by sea. At *Pembroke**, on the banks of this bay, the English Government has established an arsenal, intended, exclusively at present, for the building of ships of war. Having already given some details on this subject, in treating of the *Naval Power*, &c., it would be superfluous to repeat them here.

Both in time of peace and war, Milford-haven is of the highest importance to the interests of commerce, on account of its admirable situation at the southwest point of Wales. It affords excellent anchorage to those merchant-vessels which, either in entering or going out of the Bristol Channel, have need of a secure shelter from foul weather or contrary winds. This bay is prolonged inland by the rivers Dugledy and Cleddy, which fall into it, and which are navigable as far as Haversford and Narberth, to which places is brought the produce of the coal-mines and chalk-pits, which are worked in the valleys watered by these rivers.

Quitting Milford-haven, and pursuing our course along the coast of Wales, in an eastern direction,

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* Pembroke had very few inhabitants before the erection of this establishment; at present it reckons 4925 souls; eighty-nine commercial vessels are registered in its port, measuring 4235 tons.

we pass before Tenby, a town containing 1554 inhabitants, and much frequented during the bathing season, having, among other attractions, assembly-rooms, card-rooms, a theatre, reading-rooms, *&c.* An active coasting trade is carried on at Tenby, both in fishing and coals, considerable quantities of which are exported from this place to Ireland.

Llangharn, at a short distance from Tenby, forms a part of the county of Caermarthen; it has only 1391 inhabitants; it is situated at the mouth of the Taye, and at no great distance from that of the Towy, which flows to Caermarthen; this is the principal town of the county which bears its name, and possesses 8906 inhabitants. Vessels of 250 tons may come up as far as this town; it is indebted to commerce for its population, which is considerable for a Welch town.

Continuing to go along the coast, we pass before port Kidwelly, where there is a very convenient quay; near this place are docks, capable of receiving from twelve to fifteen vessels. This town is in the neighbourhood of abundant iron and coal mines; it has founderies and machines for working metals into sheets: the productions of these establishments are brought to this port by a canal. Kidwelly reckons 1450 inhabitants.

The province of Wales is rich in iron and coal-mines, the beds of which are so situated near each other, as to render the working of them easy and economical. The produce of these mines, in the north-west part alone, amounts annually to more

than 200,000 tons. In this part of the country is found a species of pit-coal, which burns without emitting any flame.

In the part of the south which we are now visiting, the coal is bituminous; immense exportations of it are made to Ireland, England, and France.

After quitting Kidwelly, we enter a large and deep bay, which is bounded, south, by the peninsula of *Swansea*, in the county of Glamorgan. In this bay, we find the small port of Llanelly, near which an iron rail-way, fifteen miles long, terminates. By this road, the produce of the coal and iron mines of the neighbourhood is brought to the sea-side.

At the bottom of Bury Bay, is the mouth of the river from which it takes its name. This river is navigable as far as the village of Llonghor, on an extent of ten miles.

We now go round the peninsula of Swansea, on which are some copper mines, and reach, towards the eastern part, the town of Swansea itself, one of the most important towns on the Welch coast; it reckons 10,255 inhabitants, and 115 vessels, measuring 7500 tons. At the mouth of the river Towe, or Towy, near which the town of Swansea is built, is an excellent sea-port; it has been formed by the construction of moles, under the direction of Captain Huddart, the inventor of the improved mode of rope-making.

Near Swansea, are furnaces for casting copper, and for baking porcelain, the rough materials

of which are brought from Cornwall. There, are also to be found manufactures of tin, iron wire, cylinders for sheeting metals, *&c.* A number of canals and iron rail-ways promote the economy, and, consequently, the prosperity of these establishments. Such are the details of the magnificent system of the public ways, which are all directed to that part of the coast, which we are now describing.

On quitting Swansea, and taking a direction parallel to the course of the Towe, we see, on one side, a canal which, on a distance of eighteen miles, rises 411 feet; and, on the other, a line of iron rail-ways, one of which extends to a distance of nearly seven miles. A canal, three miles in length, on one level, goes from the port of Swansea to the mines of Llanfernlet.

At the bottom of the bay of Swansea, is seen the port and town of *Neath*, which reckons 2823 inhabitants; it is surrounded by iron and coal-mines, and by establishments in which tin, copper, *&c.* are wrought, as in the environs of Swansea. Neath is at the mouth of the river of the same name, and on the banks of a canal which runs parallel with this river. This canal reaches the sea-coast, at a place called Britton-ferry, which is a convenient place for the lading of vessels; it extends up the valley of Aberferguen, where it joins the iron rail-way, which connects it with the head of the canal of Aberdare, which communicates with that of Glamorgan. The canal of the Neath is

thirteen miles and two-thirds in length; the produce of the mines of this neighbourhood is conveyed to it on iron rail-ways. From Britton-ferry, a canal three miles in length, and the property of one single individual, traverses the marshes of Crumlin, as far as the collieries of New-Chapel.

After leaving Neath, we find no port worthy of notice, till we reach *Cardiff*, which is a manufacturing and commercial town, containing 3521 inhabitants, and fifty-three ships, measuring 3028 tons. The importation of tin ore from Cornwall, and the exportation of sheet tin, coal and iron, form the principal sources of its prosperity.

Cardiff is at the mouth of the Taff, a river parallel to which runs the *Glamorgan Canal*. The entrance of this canal into the river is closed by lock-gates, through which vessels of 300 tons may pass; they are received into a basin formed for this purpose; the dimensions of the canal itself do not allow its receiving vessels of such great burden. But the numberless works of art, which it was found necessary to erect, in order to overcome the obstacles presented by the nature of the localities, made the expenses of the construction of this canal amount to more than 500,000*l.* sterling: yet, immense as this sum is, its revenue has returned a dividend of twelve per cent.

The *Cardiff Canal* crosses the Taff, by means of an aqueduct, near the place where it joins, in the west, the canal of Aberdare, and the iron rail-way

of Merthyr-and-Cardiff, which runs parallel to the eastern bank of the Taff. On quitting the aqueduct above-mentioned, the canal of Cardiff rises about 611 feet, till it reaches the magnificent forges of Cyfartha*. In order to facilitate this ascent, a great number of locks were required; on one single spot, there are more than seventeen in immediate succession. This canal is in part fed by the waters drawn from the mines in the neighbourhood; when it is requisite to supply the upper part, it is supplied from the waters of the Taff, which are raised by a steam-engine of sixty-horse power; this machine is situated only three locks below the summit level. The produce of the rich and numerous mines of the different valleys which join the principal vale of the Taff, is conveyed to this canal on iron railways, which traverse a very hilly country.

The same advantages, found in constructing the Cardiff canal, parallel to the Taff, have led to the formation of a branch which runs to the town of Aberdare, and which is parallel to the Cynon. It is prolonged by iron rail-ways which pass by the establishments of Abernant, Aberdare and Kirsvain,

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* The produce of this mine is conveyed to the canal through a short branch of the same, in small barges made of iron, fifteen feet long, and eight feet wide, and which draw two feet of water. From the solid nature of their structure, these barges stand in need but of little repair, so that they are found economical in the end. We will speak of this fine establishment when we come to treat of the *productive power* of Great Britain.

and, afterwards, clear a defile, at the summit of a precipice, by an inclined plane* of considerable extent; then descend the vale of the Neath, and form a communication with the canal of that name.

A project has been formed of uniting the canal of Aberdare with that of the Neath, which, like that of Swansea, terminates in the port and bay of that name. It is by these two lines of navigation, that the copper and tin ore, dug from the mines of Cornwall, is conveyed to the manufactories established near the rich coal-mines.

East of these hydraulic ways, is another system of artificial navigation, not less remarkable, and constructed to perform the same kind of service, in similar places. It comprises the canal of Brecknock, which is parallel with the Usk; and the two branches of that of Monmouth, from the town of Brecon, at which it commences. All these means of communication were opened nearly at the same period, *viz*:—

Canal of Brecknock, 1793; Monmouth, 1792; Cardiff, 1796; Aberdare, 1793; Neath, 1791 to 1798; Swansea, 1794.

Each of these canals is prolonged by means of iron rail-ways, on all those elevated points where navigable branches of canals were impracticable, for the purpose of reaching those mines that lie in

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* On this inclined plane, the wagons are drawn by a machine, constructed according to the plan of Mr. Trevithick.

the deep valleys; the nature of these roads, as well as their vast extent, are well worthy of attention, particularly those on the banks of the Monmouth canal. We will now resume our way along the coast, as far as the mouth of this canal.

Not far from Cardiff, and continuing our way up the bay of the Severn, we come to Newport, a town in the county of Montgomery, built at three miles and three-quarters from the mouth, and upon the banks, of the Usk. Newport reckons 4164 inhabitants, and owes its riches to commerce: its haven is very good, and is the resort of the barges which come out of the canals we are about to describe.

*The Canal of Monmouth** begins at Pillgwelly, upon the Esk, passes at Newport, and afterwards Malpas, and then divides into two branches. The west branch, which is eleven miles in length, ascends the vale of the Ebbwy, as far as Crounlier-bridge. There, iron rail-ways, upon a length of twenty-one miles, give a greater extent to commercial communication, by means of branches leading to the principal mines and manufactories of the adjacent valleys.

The east branch is the principal; it ascends 447 feet, as far as Ponty-Pool, on an extent of twelve miles and one-third; it is prolonged five miles and a

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* Each lock of the Monmouth canal is sixty feet in length by ten in breadth. The upper gate has but one flood-gate, the lower one has two.

half farther, by means of an iron rail-way, which also ascends 608 feet, and runs to the forges of Blaven-Avon. Many similar ways join also the Monmouth canal. The most important is that of Sirhowy; it leaves the canal at Pillgwelly, crosses the Ebbwy over a bridge of sixteen arches, rises in a parallel direction with the river Sirhowy, passes the great forges of Tredgar and Sirhowy, and runs as far as the chalk-pits at Trevil, on an extent of twenty-eight miles and a half. The same road, after passing the Black Mountains, joins at Brecon, the valley and rivers of the Usk. The opening of this commercial road has tended to lower very considerably the price of coal in the counties of Radnor and Hereford. The rail-way of Sirhowy, to which a number of branches are attached, is established by the side of an excellent turnpike road.

The inclined planes, employed on the Monmouth canal, and which connect it with iron rail-ways, have in general an inclination of 45°. The wagons used upon these inclined planes carry two tons and a half.

The summit level of the branch of the canal, which runs towards the Ebbwy, is about eight miles in length. Near this level, is a steam-engine for the purpose of raising from the bottom of the valley in which this river runs, the wagons laden with the coals which are to be conveyed on the canal. These wagons come by an iron rail-way which crosses the

Ebbwy over a bridge of three arches; they then ascend an inclined plane 658 feet in length, and reach a platform in which are two hatchways, through which the coal falls into the boats.

There are many rail-ways on the right bank of the Ebbwy; one of them, which goes to Newport, crosses this river and the adjacent marshes, over a bridge of *thirty* arches. The traffic upon all these roads, bordering upon the canal, is so great, and the number of wagons required is so considerable, that a manufactory has been established for the sole purpose of preparing the grease necessary for the wheels!

In the environs of the Monmouth canal, a great number of munufactories are established for the working of metals. Near a large copper foundery, is seen a cast-iron slide, constructed for the purpose of rolling down the chalk, dug out of a pit, on the other side of the canal, from the towing-path to the bottom of an adjacent meadow *.

It will naturally be imagined from the multiplicity of inclined planes, and the extensive works of art which so uneven and hilly a country rendered necessary, that the proprietors of the canal have been compelled to levy a heavy toll, in order to receive a fair interest for the capitals embarked.

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* This slide, which is 164 feet in length, and sixteen inches in breadth, is composed of plates about eight feet and a half in length, and fixed by strong bolts on a perfectly level ground.

It was, therefore, of the utmost importance that the weight of the articles transported should be exactly ascertained, in order to prevent a fraud, the more active and ingenious, as its object was to render the tolls less. Such is the object of the apparatus, which has been very recently constructed for weighing barges, the load of which must never exceed twenty-four tons and a half.

The canal of Monmouth cost 300,000*l.* sterling; it pays 3000*l.* annually for the right of communicating with the Brecknock-and-Abergavenny canal, near Ponty-Pool. This line of navigation crosses the river Avon, by an aqueduct, and, after passing a tunnel of 218 yards, runs west of the Usk, on the same level for the distance of fourteen miles and a quarter. From this place to Brecon, on a distance of eighteen miles and one-third, it rises sixty-nine feet. Iron rail-ways, with inclined planes, unite with the same line of navigation: its total extent from Brecon to Newport, is about thirty-three miles.

In ascending the northern bank of the Severn, we meet with no port worthy of notice, after Newport, till we reach Chepstow, a town of 3000 inhabitants, built on the banks of the Wye, near the confluence of this river with the Severn, which is very narrow at this place. This want of breadth causes spring tides sometimes to rise here as high as fifty-nine feet; this frequently renders the towage of barges on the Wye very inconvenient and difficult.

As we ascend this river we go,—1st, to Monmouth, the capital of the county of the name, containing a population of 4164 souls; 2ndly, to Hereford, another capital of a county, with a population of 9090 souls; a great part of the prosperity of the latter town is owing to its industry, which would be still more thriving, if the navigation from Hereford to Monmouth were attended with less difficulties; 3dly, to Hay, a small town which reckons only 1319 inhabitants. At this point, the Wye terminates its navigable course, the total extent of which is eighty four-miles and a half.

Hereford stands at the confluence of the Wye and the Lugg, which goes as far as Leominster, a town containing 3651 souls, and crosses the Kingston Canal; the town of this name contains 1980 inhabitants, and is situated in the county of Hereford. This canal passes to Tenbury, which reckons 1008 inhabitants; it falls into the Severn, almost opposite the entrance of the Wolverhampton Canal.

We will now return to Chepstow, to continue our course along the right bank of the Severn. The river is still very broad at the small town of Newnham, afterwards it narrows very much, turns to the east and then to the north, in its way through Gloucester.

Gloucester, the capital of a rich and fertile county, reckons 9744 inhabitants. Vessels come from the sea up to this city, which was a Roman station, as its name indicates, and is one of the keys of

Western Britain, as the choice of the Romans shows. Gloucester possesses an ancient bridge, built in the reign of Henry II. with long causeways, which have a great number of arches, to allow the waters to flow off from the neighbouring meadows. The cathedral of this city is remarkable for its grandeur, but not for its regularity, nor for the uniformity of its style of architecture. Formerly the houses were of wood, which gave occasion to frequent fires; at present the greater part are of brick. Since the middle of the last century, the streets and public buildings have undergone important improvements—the water necessary for the consumption of the inhabitants is conveyed in an aqueduct from a distance of about one mile and a half. The college of Gloucester is much esteemed, and its charity-school richly endowed; but a circumstance which above all merits to be known, is, that this city was the first in England where Sunday-schools were established, an institution for which the public is indebted to Mr. Rich, a printer of this city. By this happy and generous conception, a tradesman is now entitled to rank among the benefactors of the three kingdoms! And here we may be allowed to express a hope that France may one day have its Sunday-schools, for the instruction and *moralization* of the poor and the labouring classes.

In the neighbourhood of Gloucester is Cheltenham, which, for some years past, has become celebrated

for its mineral springs. An iron rail-way, serving for the conveyance of coal, runs parallel and contiguous to the road between these two towns.

Situated on the banks of the Severn, and in the neighbourhood of many extensive canals, Gloucester stands in a situation highly advantageous to commerce. It cultivates different branches of industry with success; among others, the preparation of hemp and flax, but above all, needle making, which, of itself, employs more than 1600 persons, and is carried on in nine or ten establishments.

We shall not enter into any particular details relative to the navigation of the upper Severn, as we have shewn in our preceding volume, according to what system this navigation is connected with the canals of the centre of England and Wales. We shall confine ourselves to a few general observations. The Severn is navigable on an extent of 164 miles. The following is a table of some of the distances which it runs, with their respective rise:—

From Gloucester.	To Worcester.	To Stourport.	To Bridgenorth.	To Coalbrookdale.	Totals.
Distances . .	25 miles.	13 miles.	18 miles.	11 miles.	67 miles.
Total ascent .	10 feet.	23 feet.	42 feet $\frac{4}{12}$	29 feet $\frac{6}{12}$	104 feet $\frac{10}{12}$
Ascent per mile	4 in. $\frac{9}{12}$	1 foot $\frac{9}{12}$	2 feet $\frac{4}{12}$	1 foot $\frac{8}{12}$	1 foot $\frac{7}{12}$

The Severn presents but few works of art, with no locks or weirs. During heavy rains, its navigation is interrupted by the great floods, which extend very considerably. Montgomeryshire, in which this river takes its rise, contains some low lands,

which are protected from these inundations by embankments; the consequence is, that the main stream being confined in a narrower bed, flows with greater rapidity than before *.

Bristol. It is but eighty years since Bristol, next to London, was the most commercial, the richest, and the most populous town of Great Britain; at present it is surpassed, in almost all these respects, by five other towns, Liverpool, Manchester, Birmingham, Edinburgh, and Glasgow. Its population which, in 1736, was estimated at 80,000 inhabitants, had only risen to 87,779, in 1821. It reckons 301 vessels, measuring 36,401 tons, which is but the fifth of the tonnage of the ships registered at Liverpool, and the twenty-fourth of those ships registered in the ports of London!

Still, Bristol is one of those commercial towns which nature has, in a particular manner, favoured. It is situated at the confines of the counties of Gloucester and Somersetshire, two very productive provinces, which supply it in abundance, and at a low rate, with articles of food and fuel † for its inhabi-

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* The barges which navigate upon the Severn are 120 feet in length, and from nineteen feet $\frac{3}{12}$ to twenty feet in breadth; they are five feet in depth; they carry above 100 tons. The trows are sixty-six feet in length, twenty in breadth, and five feet in depth, and carry seventy-five tons. They carry a square sail, and have a main-mast and top-mast.

† Vast strata of coal, which are worked near the town, extend even under its streets; it is surrounded by quarries which supply a

tants, manufactures, and shipping. It is more advantageously situated than any other great port either of England or Scotland, for trading with America; it stands opposite to Ireland, and almost at the mouth of the Severn, at the confluence of the Frome and the Avon; it is connected with the centre of England, with the great ports of London, Hull, and Liverpool, and with the manufacturing towns of Birmingham, Manchester, *&c.*, by the admirable system of canalization, which we have explained in our preceding volume. Such are the sources of its commercial opulence.

This opulence has long rendered the fairs of Bristol famous, which, even now, are very rich and much frequented. I was much struck with the multitude of people from the adjacent country, who assemble to take a part either in the business or pleasure of these periodical meetings*.

Bristol is the birth-place of John Cabot, and of his three sons, Louis, Sanctus, and Sebastian, who discovered Newfoundland, in 1527, and, soon after, many other parts of North America. In 1556, Sebastian Cabot obtained the sanction of Queen Elizabeth, for the institution of the Company of

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very fine stone for building, and with chalk pits of a very excellent quality.

* The principal one which I saw is held in September, the other takes place in March.

Merchant Adventurers, of which he was the first governor*.

We cannot help noticing, *en passant*, the arms of Bristol, which ought to be those of every merchant port. They consist of a ship and a fortress, with these words for motto: *Virtute et industriâ.*

Bristol, like Liverpool and Glasgow, is, at the same time, remarkable as a maritime port, and a manufacturing town. It was near Bristol that brass first began to be wrought in Great Britain: great quantities of yellow brass and sheet copper are still manufactured there; zinc is also purified and prepared there with great success. It was in this city that the process of making shot, by dropping melted lead, from a considerable height, into water, was invented. Bristol has many establishments for refining sugar, renowned manufactures of soap, glass-houses, the produce of which is exported to Spain, Portugal, and both North and South America, and a pottery of the same kind as the Etruria establishments, in Staffordshire. The manufacturing of cloth was once very flourishing at Bristol, but now transferred to other parts of England.

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* This company was founded under Edward VI.; but having lost its privileges, it is nothing at present but a benevolent association. The lands in its possession, yield about 3200*l.* per annum; this sum is applied to the relief of disabled merchant seamen, as well as to the promoting industry and commerce by offering rewards and prizes.

Bristol is remarkable for several large and regular squares; the buildings in the new quarters of the town are well constructed, and the streets laid out with good taste. We observed markets, which are kept separate, and covered in, after the manner of those in Paris, for the sale of all kinds of provisions. At a short distance from the city is a range of hills, the springs of which furnish an excellent supply of water, which is conveyed by pipes both to private houses and to the public fountains.

Bristol possesses many remarkable buildings. Its cathedral was formerly one of the most extensive and magnificent religious monuments in England; nearly two-thirds of it were pulled down under the reign of the Reformer, Henry VIII. Among the great number of monuments which it contains, monuments altogether unable to save from oblivion the vulgar crowd, whose only titles consisted in their birth and riches, we will notice that of Eliza Draper, who will live in the memory of men as a model of sentiment, grace, and perfection, as long as the writings of Sterne, in spite of their mannerism and affectation, continue to exert their gentle influence over the sensitive heart. Under an arch of Italian marble, two beautiful figures, representing Genius and Beneficence, are grouped near a pedestal, supporting a funereal urn, from which artlessly falls a garland of flowers: it is the work of the sculptor Bacon.

Another church, admired for the grandeur and elegance of its architecture, is St. Mary's, in the

parish of Redcliffe. There, upon the tomb of a merchant, William Canning, we read, that in the fifteenth century, this merchant, who was five times Lord Mayor of Bristol, and who repaired the church of Redcliffe, alone possessed ten ships, measuring 2470 tons. This fact alone suffices to show the early and rapid progress which commerce had made in this city.

Among the commercial buildings, we will only describe the Exchange, built in 1743, at an expense of 50,000*l.* sterling; the Commercial Rooms, which are composed of reading and meeting-rooms, in which merchants are received at all hours; the Merchants' Hall, and those of several corporations; the City Library, open to subscribers only; and lastly, the Theatre, and Assembly Rooms.

Clifton-hill, which joins Bristol, is renowned for its mineral springs, the celebrity of which may be traced back to the time of the Romans. Next to Bath and Cheltenham, there is no place more frequented than Clifton.

In describing minutely the establishments for the purposes of instruction and benevolence, which Liverpool possesses, we were desirous of showing, by a striking example, what the inhabitants of commercial towns are capable of doing, in this respect, when guided by generous and enlightened views. If we were to enter upon a description of the same kind, of the establishments to be found in other ports of England, we could afford our readers no new informa-

tion, and should only be repeating the observations we had before made. With respect to Bristol, we shall simply observe that it contains a great number of schools, not only for the opulent classes, but particularly for those who have not the advantages of fortune. We might cite, among others, the Diocesan school, in which more than four hundred poor children are instructed in religious principles, according to the method of mutual instruction: a thing which *we* believe impossible, on this side the channel. We may also mention fourteen charity schools, in which 450 indigent scholars are instructed, by means of voluntary subscriptions. We may mention twenty-seven alms-houses, five great hospitals, an asylum for orphans, another for the blind, three for women reclaimed from a vicious course of life, one for lying-in women, *&c.* Such are the institutions which show that commerce, so far from drying up the springs of benevolence in the heart of man, on the contrary, opens them to all the effusions of generosity and benevolence.

The corporation is one of the richest in England, and one of the most worthy so to be, from the noble use which is made of its opulence. They employ their revenues in the erection of establishments of charity and public utility; in the support of free schools; in providing lectures and sermons, the object of which is to render the people more enlightened and virtuous; in releasing from prison honourable but unfortunate debtors; in providing

with marriage portions the daughters of poor citizens; in advancing sums of money (sometimes to the amount of 100*l.* sterling) to the young disciples of industry, who discover talents for business, but are prevented by a want of pecuniary means from commencing an establishment. Such is the noble model which we offer to the imitation of the municipal bodies and heads of departments in Paris, and throughout all France.

We will now describe the great public works of Bristol, as they relate to maritime commerce. The Avon, which, from Bath to this city, waters a magnificent valley, is at present navigable* through the whole of this extent; it falls, at the distance of eight miles below the latter city, into the spacious bay which forms the Bristol Channel. The various productions of Wales, brought to the banks of the Severn, which waters this district, are conveyed by water to Bristol, and there, exchanged for those commodities which are necessary for Wales; and afterwards sent to foreign countries, or dispersed into the interior of England by an immense chain of canals.

The Frome, below its junction with the Avon,

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* The works necessary for accomplishing this object were undertaken, according to an Act of Parliament, dated 1711. It was in 1727 that the first barge, laden with deal, flour, and lead, ascended as far as Bath.

presents a large artificial basin, which traverses, nearly from north to south, the half of Bristol. By means of this basin, instead of a rivulet which was not navigable, they have procured the advantage of a spacious port, and a grand range of quays, sufficient to float merchant vessels of considerable tonnage, and to load and unload them in the very heart of the city. The Avon presents another basin, twice or thrice as large, and four times as long. It has a communication with that of Frome, and their waters are always kept at the level of high-water mark.

The ships which come up the Avon enter first by a lock into an entrance-dock, which may be let dry at pleasure. This is Cumberland Dock. Another lock, established near the former, and upon a parallel axis, allows of one vessel going out, while a second is coming into the entrance-dock. Lastly, by means of a third lock, vessels enter the long basin of the Avon and the Frome.

When these vessels draw too much water to float in the long basin, they remain in Cumberland Dock, which has a greater depth of water; they are unloaded, and afterwards brought into Long Basin. An arrangement, the reverse of this, serves for the lading of the same vessels.

To give a course to the waters of the Avon, a canal, called the New River, extends nearly from east to west, leaning rather towards the north at its

two extremities. It is south of Long Basin, and comes, west of Cumberland Dock, to join again the old bed of the river.

The locks, established at the head of Long Basin, prevent the waters from flowing off into the canal; at the same time they enable the barges coming down from Bath to enter this basin, and to come and load and unload in the heart of the city.

Twelve bridges of stone and four of wood, are thrown over the basins and water-streams which traverse Bristol.

These immense works are perfectly well calculated to afford maritime commerce all the facilities and resources that could be desired. The most ancient among them do not yet date a century, and the last have been completed only within these few years. It was in 1804, that the inhabitants of Bristol obtained an Act of Parliament for excavating the bed of the New River (or derivatory canal of the Avon) across the meadows situated south of the town; this work was completed in five years, during the most active time of the war.

Near Cumberland Dock, north of the western extremity of Long Basin, is a large dock of a square form. It was begun in 1767, and, in 1769, was capable of admitting a seventy-four into its waters; in other respects it has nothing remarkable in its construction.

It is not so with Cumberland Dock. It is built of free-stone, which abounds in the environs of the

town. When I visited Bristol, they were cleansing out this basin. Subterraneous aqueducts, with elliptic openings, made in different points of the wall, throw out currents of water, which stir up the mud in those places where the principal water-course could reach. This latter water-course is formed by opening the four flood-gates of the lock-gate, which communicates with Long Basin. With these streams, and the assistance of men provided with rakes, the mud is carried away, and thrown into the stream of the river*.

The gates of these locks are curved, like those of the London and Liverpool Docks. At spring tides, these gates open of themselves, by the pressure of the water outside the dock; but they are closed by the habitual pressure of the waters inside during the common low tides, and even during the neap-tides.

The flood gates of the locks are of square form, and in pairs at the bottom of each gate; they are both terminated by a strong iron bar in a vertical direction; the upper part of these bars are united by a traverse of iron, having its middle hollowed so as to fit a screw, the head of which is engaged in a sort of collar fastened in a piece of timber, solidly fixed against the upper part of the gate. The part of the screw which passes through the collar is plain; just above it is a nut to prevent its slipping down; the head of the screw fits exactly a key in the shape of a T; in

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* When it was finished, I inquired of the director of the works how long it was necessary to keep up this work, and at what intervals he judged it necessary to repeat it. He told me, in reply, that it was sufficient to repeat this operation once every five years, for four hours and a half at a time.

turning this key from the right to the left, the flood-gatė is raised to any height required; it is lowered by a contrary motion.

Each gate is worked by two chains, which are attached nearly in the centre of the pressure sustained by each gate, when it bears the greatest height of water it has to support. One of these chains is placed on each side of the gate. Each of them enters the masonry work of the lock through a circular opening, resting at the same time, upon a horizontal roller of cast-iron. It reaches the bottom of a vertical well, where it turns round the drum of a capstan. The axis of this capstan rises above the level of the quay, and its upper end is terminated by a cast-iron cap.

This cap has: 1st, four mortises in the form of the trunk of a quadrangular pyramid, for the reception of four large wooden bars, which are sufficient to work the capstan. (When these bar are fixed, they form an angle of about six degrees with the horizon; they are directed, according to the continuation of the sides of a very obtuse cone, formed by the surface of the cap;) 2nd, four mortises made between the preceding ones upon the flat part of the cap, in order to plant vertically, or nearly so, the bars of the capstan, when they are not wanted. They are thus placed in a conspicuous situation, which renders it more difficult for them to be stolen. At the same time, they are placed in such a manner as not to be an obstacle to the free passage on the quay close to the locks. The cap of the capstan we have just described appeared remarkable, both for its form and the judicious distribution of metal, the thickness of which is exactly calculated in every part to offer a resistance proportioned to the efforts they have to sustain.

In proceeding along the Long-Basin, we see a great number of docks for the building, careening, and repairing of vessels. These establishments are surrounded by spacious timber-yards, with slips for the construction of new vessels. In one of these

yards I observed a dock, built of brick, 110 yards long, and terminated by a slip.

These different establishments have nothing to recommend them but their size and extent; they do not show the least pretensions to ornament or beauty; the various buildings are either of brick, rough stone, or wood. The greater part of the docks appeared to have but little care bestowed upon them, a circumstance remarkable in a country where all kinds of buildings are usually kept in such good order, as always to have the appearance of being newly constructed. Perhaps this neglect might be the consequence of the languishing state of commerce and naval constructions; for of all the towns of Great Britain that I visited, Bristol was the one where the general stagnation was most visible and most alarming.

The stocks and Dock-yards are ranged: 1st, near Cumberland dock, in the east of the long floating-basin; 2nd, on the western bank of the Frome, near the place where it branches off into the Long-basin of the Avon; 3rd, upon the southern bank of Long-Basin. This third group presents the most numerous and largest establishments. Here we find Bathurst Dock, in which vessels are kept afloat; it is a private property. One of the yards established in this place extends as far as the foot of a high scarp, almost perpendicular; a range of galleries have been excavated in the

ground at the bottom of this scarp, and on the same level with the yard. A well or shaft communicates from the centre of these galleries with an upper yard, which is on a level with the part of the town which rises, on this side, in the form of an amphitheatre. A windlass is used to convey goods from the lower to the upper yard, and reciprocally.

The cranes of Bristol are in high repute in England; I noticed one of cast-iron, remarkable for the boldness and lightness of its construction*; and,

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* It is about forty feet in height, and projects about twenty. Its sides are constructed of two pieces only. These two sides are plain, and just close enough at the upper part, to leave only the interval between them necessary for fixing a large wheel on which the chain turns; at the bottom, these sides are distant enough from each other, to admit between them the mechanism of the crane.

The chain, which bears the weight, after being made to take a turn on the wheel before-mentioned, descends along the back of the crane, and turns round a horizontal cylinder. The axis of this cylinder carries, at one end, a cogged wheel, outside the sides of the crane. This wheel catches in a pinion borne by a horizontal axis, which itself has a cogged wheel at the opposite end. Lastly, this last wheel acts upon a pinion which is turned by a double winch acting upon the horizontal axis of this pinion. The latter axis has a curb to stop the movement of the weight at pleasure, or not to fatigue the men when their action is suspended, and to prevent accidents.

The crane is fixed upon a vertical axis of iron, having the shape of a cone of very considerable volume. The crane is terminated by an inverted socket, fitting the conical axis; a strong iron circle turns round the basis of the said cone, and probably

not far from it, another, the mechanism of which is concealed by a square case which turns with it*.

We will now quit Bristol to continue our journey along the western coast of England. We drop down the Avon as far as the sea, and, turning to the south-west, coast along a low shore, where we meet with nothing to arrest our attention, till we come to the mouths of the Axe and the Yeo, in the county of Somerset.

The Axe ascends to Glastonbury, a town of 2213 inhabitants, remarkable for the ruins of an ancient and celebrated abbey. The Yeo, or Ivel, is a river of much more importance than the Axe; it passes by Bridgewater and Langport.

Bridgewater, a town containing 6155 inhabitants, reckons forty-eight ships, measuring 2975 tons; the tide rises as high as forty feet before this town, and by its violence, frequently occasions great injury to

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upon a set of wheels similar to those of our great capstans. When the crane is to be turned upon its own axis, the windlasses are pushed either to the right or the left, without turning them.

* There is a door which is kept locked, but by which the parts of the machinery, generally concealed from sight, may be visited when it is thought proper. On the outside, we see two systems of winches essentially distinct; the one serving for the raising of weights, the other for the rotation of the crane. The two men who work this crane told me that they could raise a weight of three tons, that is, one ton and a half each; nevertheless the working of the crane is very expeditious, and effected without any noise being heard.

the vessels moored in the Yeo. The trade of Bridgewater chiefly consists in the export of the agricultural produce of the county of Somerset, and the import of such commodities as are necessary for the consumption of the inhabitants of this county. Barges go up as far as Langport, an intermediary depôt, to which the London stage wagons, as well as those of the inland towns, come, laden with articles intended for maritime commerce.

Beyond the Yeo the coast takes a direction from east to west, and we find on its banks,

I. *Watchet*, which was formerly a mercantile port of some note, and the centre of the great herring fishery; at present its vessels are principally engaged in the conveyance of the ashes of burnt seaweed, for the glass manufactures of Bristol; they are also loaded with coal,—a kind of alabaster found in its neighbourhood,—and a species of stone, which is converted into an excellent hydraulic lime.

II. *Minehead*, a secure and commodious port, at the foot of a rocky and rugged coast. Commerce flourished there at the commencement of the last century: an extensive traffic was carried on with Ireland and America: more than 4000 casks of herrings were exported to the Mediterranean; but since the herrings have ceased to visit this coast, the importance of Minehead has disappeared. This port at present has only 1,239 inhabitants, and twenty-eight ships, measuring 1,325 tons.

Still continuing our course towards the west, we

pass from the coast of Somerset to that of Devonshire, and double

III. *Ilfracombe,* which reckons 2622 souls. Its port, which is protected by a mole, offers a secure anchorage for vessels of large burden. The port is surrounded by a semicircular range of hills, which contributes much to its security, and affords a residence at once picturesque and salubrious to the invalids, who come hither for the sake of sea bathing. Boats procure a frequent and regular communication between Ilfracombe, Bristol, Swansea, and Milford.

Below Ilfracombe, the coast turns to the south, as far as the mouth of the Taw, in the bay of *Barnstaple,* a town situated on the banks of this river, which is crossed on a bridge of sixteen arches. Vessels anchor along a large quay, which extends a considerable way beyond the bridge. The mouth of the Taw is obstructed by an extensive bar, which prevents vessels of more than 200 tons to enter the river; yet, in spite of this obstacle, Barnstaple reckons forty-six vessels, which measure 2734 tons. It is a manufacturing town, and employs a great number of workmen, in the manufacturing of flannel, silk stockings, *&c.* Among other objects, this town does not neglect the cultivation of the mind; its college has formed some distinguished men of letters; among others we may name the poet Gay.

The Torridge, which passes through Torrington

and Bideford*, falls a little below the latter place into the Taw, near its mouth.

Bideford reckons 4053 inhabitants, and 108 vessels, measuring 8694 tons; this is more than any other port laying south of Bristol. Merchant vessels anchor in the river along a quay of considerable extent. Bideford carries on a great coasting trade with Ireland and Scotland, conveys to Wales the produce of the mines of Devonshire and Cornwall, and carries on the fishery upon the banks of Newfoundland.

Quitting Torridge, we follow the southern shore of the Bay of Barnstaple to the promontory which takes its name from the small port of Hartland, which reckons 1968 souls. This port is artificial, and its construction dates from the reign of Elizabeth; it is principally frequented by the fishermen of the coast.

Doubling Cape Hartland and turning to the south, we soon reach the county of Cornwall, the last on the western side of England. We find no place of any note till we reach the long, wide, and deep entrance of the Camel, a river which goes up to *Bodmin*, a town containing 2902 inhabitants, whose principal occupation is the scouring and carding of wool. Towards the mouth, and on the southern bank of

* At Bideford, the Torridge is crossed by a Gothic bridge of twenty-four arches; it is 225 yards in length, and was built about the middle of the fourteenth century.

the Camel is the small town of Padstow*, which contains only 1700 individuals, and fifty-eight ships, measuring 3081 tons. This port is the best of all the coast we are now visiting. Ships of 500 tons may enter and moor in it with safety. Opposite Padstow the channel is eighteen feet deep, even at low water, and 429 feet in breadth; vessels come alongside the quay, on which stands the custom-house.

South of the Camel we find no maritime station of importance, till we reach the bay of St. Ives. The town of *St. Ives* reckons 3526 inhabitants, and sixty-five vessels, measuring 3635 tons; it is situated on the southern side of the bay. Its fishery, and the conveyance of the minerals and slates got in Cornwall, are the principal objects of the trade of this port, which, on account of the banks of sand, formed by the strong north-western gales, is very inconvenient, and fit only for vessels of small burden. Below St. Ives there is no other port of any consequence till we reach the promontory of Land's End.

We will terminate our description of the western coast of Great Britain by a table of its statistic data, to which we shall again refer in the general comparison, which we reserve for the last chapter of this volume.

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* A name corrupted from *Patrick–Stow*, or place of St. Patrick.

Division of the Coast.		Population.	Square miles.	Inhab. per sq. mile
Scotland Highlands	North West	108,150	5,456	20
	South West	113,400	3,353	33
Lowlands	Clyde	521,400	2,253	231
	Solway	145,900	2,552	57
TOTAL		888,850	13,614	65
England	Cumberland & Westmorland	211,700	2,241	94
	Lancashire & Cheshire	1,349,500	2,882	468
	Wales, West	369,850	3,331	111
	Severn	2,392,400	4,146	571
TOTAL, England		4,323,450	12,600	343
TOTAL, England and Scotland		5,212,300	26,214	199

BOOK VI.

SOUTHERN COAST OF ENGLAND.

CHAPTER I.

Southern Coasts of Cornwall and Devonshire.

We now double the promontory of the Land's End to follow the southern coast of England, and pass between the main land and the Scilly isles, where eleven ships, measuring 460 tons, are registered: we enter a bay, the shores of which present to our view the three ports of Penzance, Marazion, and Helstone. In this bay both the vessels returning to England, and those preparing to quit it, find a secure shelter, to wait for favourable winds.

Penzance has 5224 inhabitants; forty-seven ships, measuring 2798 tons are registered in the custom-house of this port; it lies nearly dry at low-water, and it is not above fifty years since a mole was constructed to protect it. *Marazion*, which is also called Market Jew, is a small port which has nothing worthy of notice. *Helstone* is built upon the banks and near the mouth of the river, which bears the two-fold name of the Cober and the Looe; the port

stands a little below the town; ships come to this port to fetch tin from the Cornwall mines.

The Lizard-point separates the bay in question, from another of much greater extent. The latter contains a great number of mercantile ports, and one of the most important military ports of Great Britain, *viz*. Plymouth.

Going round the coast, east of the Lizard-point, we immediately enter a very irregular and narrow bay, which runs to a great distance inland. No city or port of any note is found upon its shores; but at a short distance on the other side of the bay, the river Fale empties itself near the town of *Falmouth*, which reckons seventy-seven ships, measuring 8712 tons, and employs a great number of vessels. In 1664, Falmouth had but 200 inhabitants; at present their number amounts to 4392. It is the place of the arrival and departure of the packets, bound for or from Spain, Portugal, and the West Indies. These packets bring to England great quantities of gold and silver, in return for British exports.

Ships of considerable burden may come alongside the quay at Falmouth; the port is spacious, well sheltered by the surrounding lands, and protected by two castles, east, by St. Maws, and west by Pendennis. The latter is situated upon a rock, which stands above 120 yards above the sea, at the extremity of a tongue of land at the entrance of the Fale; it is an excellent military position. This castle was built by Henry VIII., and was afterwards fortified

by Elizabeth, and, still later, by Oliver Cromwell, after he had taken it, with much difficulty, from the royal troops.

Penryhn stands at the bottom of the long and narrow creek, at the entrance of which Falmouth is built. It carries on a considerable trade in the drying of sprats, which are afterwards brought to London and other markets; it has 2933 inhabitants, and eleven ships, measuring 830 tons.

Truro stands at the confluence of the two rivers which empty their waters into Falmouth haven. It is at Truro and Penzance that the bars and ingots of tin, brought from Cornwall, are stamped. At Truro, is a foundry for reducing into smaller pieces the tin brought from the mines; it is there reduced into ingots, weighing above 66lbs., or bars weighing from five to ten pounds. The ingots are sent to the Baltic and the Mediterranean, and the bars to the East Indies. Great quantities of copper ore are also exported from Truro, and shipped for Wales. This port reckons 24 ships, measuring 1176 tons.

Barges ascend the Fale, as far as *Tregony;* but this town has fallen from its former importance, since Truro has monopolized the principal branches of the trade carried on by this part of the county of Cornwall.

After continuing to coast the bay of Falmouth, we come to the eastern side of its entrance, commanded by the castle of St. Maws. On the left we leave a creek, in front of this fort; we double Cape St. An-

thony and those of Pennand and Deadmans. Farther on, we meet the mouth of the Fowey, near which stands the town of *Fowey*. It is built on the western bank of the river. This small town, which has only 1455 inhabitants, has two free schools, a poor's house, and an alms-house for eight widows. A fort and two small batteries protect the entrance of the port, which reckons 79 ships, measuring 5475 tons.

The next port we meet is *Looe*, at the mouth of the river of the same name. The two parts of this town are united by a bridge of fifteen arches, which is ancient and irregular. The principal occupation of the inhabitants is fishing. The port has 32 ships, measuring 1936 tons. A battery protects the entrance of the port, and the mouth of the river.

Continuing our course towards the east, we pass between Ram Head and the celebrated Eddystone light-house, constructed by Smeaton, and described by him in an excellent work*.

We now enter the road of Plymouth Sound, leaving, to the east, the pier, or breakwater, of which, as well as of all the naval establishments of this port, we have already given an account. (See *Naval Power*, Part ii. Vol. 2.) Following the western coast of the bay, and turning to the north-east, we enter the natural basin of Hamoaze, into

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* Its structure and dimensions being the same as those of Bell-Rock, of which we have given a detail, it would be a needless repetition to offer the reader a similar account relative to Eddystone.

which the waters of the Tamer empty themselves. This river serves as a limit to the two counties of Cornwall and Devon. A canal, parallel to the Tamer, ascends as far as the village of Tamerton, and contributes greatly to the prosperity of the country.

Plymouth Dock, Plymouth, and the intermediary town of *Stonehouse**, reckon altogether 61,112 inhabitants, and 366 ships, measuring 28,613 tons. These mercantile vessels are, in a great measure, employed in supplying provisions, *&c.*, for the town, and naval establishments. The principal commercial port is in the bay of Catwater, which lies south of Plymouth. A considerable fishery of cod and sprats is carried on there, and many vessels are sent hence to the banks of Newfoundland, which makes it a nursery for excellent seamen.

Continuing our course beyond Plymouth, we arrive at Cape Bolt, at the entrance of a deep, narrow, and irregular bay, at the extremity of which is the small port of Kingsbridge. After quitting this bay, and doubling Paule Point and Start Bay, we reach the mouth of the Dart, near which are situated the town and port of Dartmouth.

Dartmouth at present occupies the site on which these villages formerly stood; it has 4485 inhabitants, and its port registers 327 ships, measuring

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* For an account of these towns, see *Naval Power*, &c.

22,036 tons. These numerous vessels are chiefly employed in the fishery on the banks of Newfoundland; they carry the greater part of the produce of their fishery into the ports of the Mediterranean, and bring back, in return, oils, wines, fruit, salt, *&c.*

A fort and two batteries protect the entrance of the port, which is perfectly secure, and is capable of receiving as many as five hundred vessels.

The Dart is navigable as far as *Totness*, a town of 3128 inhabitants, who carry on the manufacturing of woollen stuffs.

Descending the Dart, and doubling Capes Froward and Berry, we leave Torbay to the west, and ascend, to the north, as far as the mouth of the Exe. There we find the small town of Exmouth, near which the celebrated Sir Walter Raleigh was born, one of the greatest navigators of the 16th century. Exmouth, which was already important for its commerce, has become no less so for its fishery, and its reputation as a watering-place.

Formerly the Exe was navigable as far as Exeter, but the magistrates of this town having in their official power decided that no citizen of Exeter should be allowed to wear the livery of a nobleman within their township, without having previously obtained the consent of the mayor and burgesses, one of the Earls of Devonshire, offended at this noble spirit of independence of the inhabitants of Exeter, to punish them, caused large stones and trunks of trees to be thrown into the bed of the Exe, in order to obstruct

the passage between Exeter and Topsham; the consequence was, that this village, of which the Earl of Devonshire was the proprietor, suddenly acquired the whole maritime trade of the river.

In 1765 a canal was dug parallel to the Exe, between Exeter and Topsham, in order that merchant vessels might again have access to the principal town; vessels of 150 tons are now able to accomplish this. A short time, after the magistrates of the town made a purchase of the quay of Topsham, which is spacious and convenient.

Exeter contains a population of 23,479, and 211 ships, measuring 17,009 tons. The principal occupation of its inhabitants is the spinning and weaving of cotton and wool; great quantities of serge are also manufactured here. The annual exportation from its manufactures was valued at 600,000*l*. sterling, ten years since, and is doubtless, at the present time, much more considerable.

Exeter is celebrated for the grandeur and beauty of its cathedral. The county prisons of Devonshire are established in this town; during the war, extensive cavalry-barracks were erected in its vicinity. We must not forget in Exeter a great number of establishments for clothing and instructing poor children, independent of the Sunday-schools. We must also notice, among a great number of other hospitals, the extensive one of Exeter and Devon, founded by Dr. Clarke.

Sidmouth was formerly a considerable port, but

merchant vessels were obliged to abandon it, on account of the alluvions of the river, which have almost choked it up. At present, it is merely a station for fishermen, and frequented as a bathing-place; the beauty of its situation and temperature of its climate inducing great numbers of invalids to resort thither.

Axmouth, the last place in Devonshire, situated, as its name implies, at the mouth of the Axe, is nothing but a hamlet inhabited by fishermen.

CHAPTER II.

Coasts of Dorset and Hampshire.

Lyme-Regis, at the mouth of the Lyme, is the first town we meet, on the coast of the county of Dorset; it reckons 2269 inhabitants, and forty-two ships, measuring 3331 tons; the entrance of its port, which is excellent, is protected by a fort. In order to enclose it, it was found necessary to cut in the rocks, and build upon the parts thus cleared; in this manner a line of defence against the waves has been formed, called the *Cobb*. In order to keep this mole in good repair, a toll of so much per tonnage is levied upon all the vessels which frequent the port of Lyme-Regis. It is also a bathing-place.

On leaving this town, we coast along an extensive and very irregular coast, which presents no maritime station, till we come to the promontory of *Portland-race*, so called in consequence of the dangerous currents produced there by the tides. It is the southern point of a peninsula commanded by a castle, built in the time of Henry VIII., on the only place where ships can safely approach the shore. This peninsula is not interesting in a commercial point of view, except for the immense quantities of free-stone sent thence to most towns of England, but particularly

to London, where the yearly quantity conveyed exceeds 9000 tons per annum.

After passing Portland-race, we enter the bay of Weymouth.

Weymouth reckons 107 vessels, measuring 7490 tons, registered in its port, which is defended by the two forts of Portland and Sandford. Weymouth is separated from Melcombe-Regis, only by a bridge thrown over the Wye. The population of these two towns amounts to 6692 inhabitants. The port of Weymouth is perfectly sheltered by the surrounding hills; and the friendly barrier which they present against the blasts of the north, renders the climate of the place very mild; it is much frequented by invalids who wish to breathe the sea air, and enjoy the advantages of bathing.

On leaving Weymouth, we follow the coast as far as Cape St. Alban, which we double, and enter Stadland bay; by the western coast of this bay we penetrate into the haven of Poole, which is both spacious and well protected, and the waters of which are the more calm, as its entrance is very narrow, in comparison with its size.

To the north of this haven stands the town of *Poole*, which reckons 5390 inhabitants, and 141 vessels, measuring 17,470 tons. Poole, as well as Weymouth, by the number and elegance of its new buildings, affords proof of its recent prosperity.

Ships of 400 tons may be moored alongside the spacious quay which almost entirely surrounds this town. It has a small fishery, and carries on

a considerable coasting trade; but its principal commerce is with foreign ports, joined to the Newfoundland and Greenland fisheries. Towards the entrance of the haven is a bank of oysters, which are sent in great quantities to be fattened in the creeks on the coasts of Essex and the banks of the Thames.

To the west of the bay of Poole, at the bottom of Standland Bay, after passing from the coast of Dorset to that of Hampshire, we penetrate into the harbour of Christchurch, which is spacious, but too shallow and dangerous to be frequented by large vessels. It receives the waters of the Stour, and of the Avon, in the South. The town, which is called after this haven, rises at the confluence of these two rivers, which supply an abundant salmon fishery; its population amounts to 4664 souls; the port has been improved by Smeaton.

At the eastern entrance of Stadland Bay we find the *Isle of Wight*, one of the most delightful situations in Great Britain; it is twenty-two miles in length, by twelve and a half in breadth, and reckons 31,616 inhabitants. Its climate is extremely mild, and the vegetation of its territory rich and varied, which renders it one of the places to which the English resort, by preference, to enjoy the pleasures of the fine season. It has four sides, which are nearly rectilinear; the two northern sides look towards England, and the two others to the open sea. This island forms a natural shelter for the flourishing ports and excellent roads which we are about to describe on the opposite shore.

Lymington, which reckons 3,164 inhabitants, rises near a little bay, in which vessels of 300 tons may enter; they are moored close to the quay, constructed in front of this small town. Its foreign trade is very trifling; its principal resource is the fabrication and sale of sea-salt.

Opposite the projecting angle formed by the two northern sides of the Isle of Wight, is a large and deep haven, called *South-Water*, on which ships of 1500 tons may sail. This haven receives the waters of the Anton, the Itchen, the Test, *&c.* Two towns stand on its eastern shore, Southampton and Fareham.

Southampton, situated at the confluence of the Test and the Itchin, is the chief town of the county of Hants, which is also called the county of Southampton; it reckons 13,353 inhabitants, and 187 ships, measuring 8008 tons.

It was on the shore near Southampton, that King Canute gave his flatterers the celebrated lesson which we have related, (*Naval Power*, Vol. I.) by showing them that all his power failed before the eternal laws of nature. The foreign trade of Southampton is principally with the isles of Jersey and Guernsey, as well as with the western coast of France, Spain, and Portugal, which supply it with the wines and fruit of the south. A regular communication is established between Cherbourg and Southampton by means of packets; lastly, the shipowners of this port carry on the Newfoundland fishery.

Fareham, situated almost at the entrance of the bay of South-Water, is a small commercial port, the fishermen and sailors of which are principally employed in supplying the markets of Portsmouth.

To the east of Fareham, the coast of the main land lies parallel with the west-north-west coast of the Isle of Wight, as far as the entrance of the bay of *Portsmouth*.

Gosport and the hospital of Haslar rise within this bay, on the part of the coast we are now viewing; in front of us is Portsmouth, upon the peninsula of Portsea. For a description of these towns, and the establishments belonging to them, we refer the reader to the *Naval Power*, Vol. II. We shall only give the amount of their population, according to the census of 1821, the inhabitants of Alverstoke and Gosport, 10,972; Portsea and Portsmouth, 45,648; total, 56,620.

Portsmouth has 259 small merchant vessels, measuring 8820 tons, principally employed in provisioning the fleets and arsenals of the navy and of the ordnance department, as well as in supplying the markets of the populous towns which owe their riches and grandeur to these national establishments.

The celebrated road of *Spithead*, the common *rendezvous* both for ships of war and merchantmen, on their departure for long voyages, or great expeditions, lies between the Isle of Wight and the entrance of Portsmouth harbour.

CHAPTER III.

Coasts of Sussex and Kent.

THE Peninsula of Portsea, in which Portsmouth is situated, lies in the west of a spacious bay, scattered with small islands, and very irregular in its form. The city of *Chichester* is built on the banks of the Lavant, which falls into this bay towards the most eastern part. It is the chief town of Sussex, and has 7362 inhabitants, and thirty-six ships, measuring 3395 tons. A manufacture of needles and coarse woollen stuffs, and the preparation of malt, are the principal branches of business carried on at Chichester*.

Leaving the bay of Chichester, we double Selsea-Bill, and afterwards Arundel, at the mouth of

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* The Arundel and Portsmouth Canal commences at Ford, at about two miles below Arundel; it runs a distance of twelve miles and one-third, and opens into the bay of Chichester, which it crosses from east to west, to Port Langston; afterwards, by a cut of two miles and a half in length, it crosses the peninsula of Portsea. This latter part of the canal has ten feet depth of water; it has two locks which keep in the water, seven feet and a half above the level of the sea: these locks are 110 feet in length, by twenty-two feet and a half in breadth.

A branch, one mile and a half in length, goes to Chichester, and there opens into a basin constructed for the purpose. The

the Arun. *Arundel*, a town of 2511 inhabitants, reckons fifty ships, measuring 4263 tons. The ancient castle of this town, which has been recently repaired by the Duke of Norfolk, is much admired. Arundel is famed as being one of the greatest corn-markets in Sussex. On pursuing our way along the coast eastward, we find a number of villages, which are so many watering-places, where the mildness of the climate, the beauty of the situation, and its vicinity to the capital, attract numbers of visitants and invalids during the bathing season. We now reach *Shoreham*, upon the left bank and near the mouth of the Adour; Shoreham reckons 1047 inhabitants, and forty-nine ships, measuring 2443 tons; it is a fishing port, and carries on a small coasting trade.

Near this port and upon the coast, we find Brighton, a town containing now 24,429 inhabitants, but which, so recently as 1811, had only 12,012. This increase may be attributed to the residence of the Sovereign, who has erected Arabesque stables and

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part of the canal corresponding with this branch, is only eight feet in depth, and its locks are eighteen feet in width.

The canal was opened the 26th May, 1823. Barges, laden with merchandise, go in three days from London to this canal, which they traverse in another day; so that goods are transported from London to Portsmouth, by inland navigation, in four days only. The cost of freightage is one shilling per hundred weight. Fly-boats are to be established to run night and day, by which means the passage will be performed with still greater rapidity.

Chinese pavilions in this place. Every year, in the first week of August, horse-races take place at Brighton, which are much frequented. This town has many handsome buildings, and is provided with every convenience for hot and cold baths, both of salt and fresh water, with all the establishments, either of pleasure or instruction that could embellish a watering-place. By this time, we suppose that Captain Brown must have completed at Brighton a chain pier, similar to that which has been constructed for the pier of Leith.—*See plate.*

Advancing a short distance towards the east, we pass the port of *Newhaven*, near the mouth of the Ouse. It is protected by jetties, and a project is on foot for its farther improvement: it possesses but twelve ships, measuring 843 tons, but has many fishing boats.

The Ouse is navigable to *Lewes*, and can be ascended even several miles farther. Lewes is a very ancient city; it formerly reckoned twelve parishes, which are now reduced to seven: it is the centre of the great inland trade of the county of Sussex.

Returning to the sea, we double Beachy Head, but find no other remarkable maritime station till we reach *Hastings*. This place, where William the Conqueror landed, is celebrated for the victory which gave England to the Normans, and the crown to this warrior. Hastings is one among the number of the *cinque-ports* which William felt it necessary to put in

a state of defence, in order to protect the British coast from any future attempts on the part of France. For a long time this port has been choked up, and at present is only frequented by fishermen.

At a short distance from Hastings we find *Winchelsea*, another of the cinque-ports. This town has declined from its ancient splendour, and, at present, contains but 817 inhabitants, without trade or business of any kind.

Rye, another of the cinque-ports, is situated on the banks of the Rother, the mouth of which forms a spacious bay. The port is much obstructed in consequence of accumulations from the land side, and is capable of receiving only vessels of moderate size, in spite of the works undertaken at different periods, conformably to Acts of Parliament, for its improvement. Rye reckons 3599 inhabitants, and 102 ships, measuring 4311 tons. We must not forget to notice in its neighbourhood, a hamlet, inhabited by French refugees, who, for more than a century and a half have remained united by the bonds of their common country. These Frenchmen are humble fishermen.

Beyond the bay of Rye commences the coast of Kent. Doubling Dungeness we touch at New Romney, built upon an eminence, in the midst of the fertile marshes of Romney, which form a territory of more than 50,000 acres, gained from the sea, several centuries since, by means of a causeway, or dyke, constructed parallelly with the shore, from

Romney to *Hythe*, which is likewise reckoned among the cinque-ports. A large fort, and three smaller ones, at the distance of about one mile from each other, protect the approaches of Hythe, a town, having a population of 2300 inhabitants. At the back of the marshes of Romney runs the *Royal Military Canal.* See *Military Power.*

Folkstone, east of Hythe, is a town now much fallen from its ancient splendour; it forms, in a political point of view, a part of Dover, reckoned as one of the cinque-ports. Its sailors are chiefly employed in the fishery of mackerel, with which they supply the London markets, as well as in fishing herrings, upon the coasts of Norfolk and Suffolk. In Folkstone we notice a school for twenty poor children, founded by a legacy which was left by Harvey, whose name is immortalized by his discovery of the circulation of the blood. When genius and beneficence are found united, they claim both the love and the admiration of mankind.

Dover.—In treating of the *Military Power*, Vol. II., we gave the topography of this town. It reckons 10,327 inhabitants and 166 ships, measuring 8379 tons. It derives its principal riches from the constant influx of the numerous travellers between England and France. Much has been done, and much still continues to be done, towards improving the port of Dover, which stands at the mouth of a small river. To procure powerful streams, in

order to clear the entrance of this port, large pipes have been laid under ground, to let the water out of the docks, and to carry the mud away in its passage. In other respects, the maritime works of this place present nothing of which we have not already had occasion to present great models, in describing the principal ports of England and Scotland.

Beyond Dover, the coast turns towards the north. We first reach *the Downs,* a celebrated anchorage, particularly during the war. It lies facing *Deal.* This town reckons 6811 inhabitants, and but 26 ships, measuring 868 tons; but it possesses a great number of fishing-boats, as well as other small craft, employed for the victualling and service of vessels stationed in the neighbouring roads. Peace has somewhat diminished the population of Deal.

From this port, as far as the Cape of North Foreland, beyond Ramsgate, run the formidable banks called the Goodwin Sands. We observed three lanterns on board a vessel, which is always moored upon these banks for the safety of navigators.

Sandwich, which lies north of Deal, on the banks of the Stour, has declined considerably from its former prosperity, in consequence of the accumulations formed from the land side, which have blocked up the port. Still it possesses 2912 inhabitants, and 135 ships, measuring 7833 tons. It is reckoned among the cinque-ports, and the ports Fordwich,

Deal, Ramsgate, Reculver, Sarne, Stonar, and Walmer, are subordinate to it. A great part of its trade consists in the agricultural produce which descends the Stour, and is conveyed to London. This river ascends to Canterbury, the capital of Kent, which is particularly celebrated for its ancient and noble cathedral.

North of the mouth of the Stour, and on the peninsula of Thanet, is the port of *Ramsgate.* This place, which at present possesses 6091 inhabitants, is much frequented during the bathing season. Its beach, which slopes off insensibly, discovers at low water a very long and wide bed of sand, which is very favourable to bathing. This is performed in machines, which run on four wheels, and follow the progressive or retrograde course of the tide. During the war, large barracks were built near Ramsgate, both for infantry and cavalry. The works of its new port were begun in 1750. A light-house has been constructed on the head of the western pier. The eastern pier has been lengthened about 100 feet, in order to confine the entrance of the port, which is protected by batteries. A military road has been formed at the foot of the coast, to facilitate the embarking of troops. The port presents a dry dock, a wet dock, and a building dock; it has sufficient depth of water for the largest merchant ships. In fine, its situation is of the utmost importance to vessels in the channel, which are driven by gales against the English coast. The following list of the

vessels entered at Ramsgate, will at once shew the utility of this port, and the progress of British commerce:

In	1780	1790	1800	1808
Vessels	29	387	660	596

Turning the peninsula of Thanet, we pass before *Broadstairs*, a watering-place: we double Eastness, and find ourselves at the mouth of the Thames, along the southern bank of which we will ascend up to London.

The next place is *Margate*, which reckons 7843 inhabitants. Packets and steam-boats daily make the passage between this port and London. This is one of the most fashionable watering places of all those on this part of the coast. Its port is protected by a pier, built anew, according to an Act of Parliament, dated 1787. The places of public amusement established in Margate are built with taste.

Coasting along the southern side of the bay of the Thames, we have on our right, the *Isle of Sheppy*, which contains the port of *Sheerness*; and reach the southern bank of the Medway, which can be ascended as far as *Chatham* and *Rochester*. The population of these two towns amounts to 24,063 inhabitants, and their mercantile shipping to 328 vessels, measuring 12,941 tons. We have described the public works of Sheerness and Chatham, in our *Military Power*, Vol. II., and our *Naval Power*, Vol. II.

From Rochester, one may now immediately follow a canal, which has lately been opened into the

Thames, below Gravesend. The long circuit which is to be made, in going up this river, is thus avoided, including the descending the Medway.

Gravesend is, properly speaking, the first port situated in the bed of the Thames. This town reckons 3814 inhabitants. Since the time of Richard II. they have enjoyed the exclusive privilege of conveying passengers in boats from their own town to London; the price of the passage is nine-pence each passenger; they are obliged, within a quarter of an hour, at a signal given by a bell, to start with the tide; they return also with the ebb. It is at Gravesend that vessels laden for exportation or importation are obliged to stop, in order to undergo the first or last visit of the custom-house officers who do the duty of the Thames. This regulation, by rendering the port of Gravesend much frequented, contributes much to its opulence.

From Gravesend to London, we find on the southern bank bank of the Thames,

	Woolwich,	Deptford,	Greenwich,
Reckoning	17,008.	19,862	20,712 inhabitants

Thus, we find 57,582 inhabitants concentred upon a line of shore not exceeding four miles in length. We have given an account of the principal public establishments of those three towns, in describing the works of the *Military Power* and the *Naval Power*.

In completing our survey of the western coast of

England, we will give a general table of its superficies, with its population:—

Counties.	Population.	Square miles.	Inhabitants per sq. mile.
Cornwall (½) . . .	131,300	663	198
Devon (½) . . .	223,950	1,289	173
Dorset	147,400	1,005	147
Wilts (½)	110,000	609	219
Hants	289,300	1,628	177
Sussex	237,700	1,463	162
Kent *(a part)* . .	134,600	(⅖) 615	218
TOTAL . . .	1,277,250	7,272	175

CHAPTER IV.

Comparison of the three Coasts of Great Britain.

If we compare the *basins* on the three coasts of the east, west, and south, we see, according to the recent returns of population made in 1821, that for these basins, there are

	Coasts	To the East.	To the West.	To the South.	Total.
Inhabitants.	Scotland	1,246,350	888,850	,,	2,135,200
	England	6,619,900	4,323,450	1,277,250	12,220,600 *
	Total	7,866,250	5,212,300	1,277,250	14,355,800
Superfiices. Square miles.	Scotland	18,073	13,614	,,	31,687
	England	28,184	12,600	7,353	48,137
	Total	46,257	26,214	7,353	79,824
Inhabitants by the square mile.	Scotland	68	65	,,	68
	England	235	343	174	254
	Total	303	408	174	180

We will now pass to the statistic results of its

* According to the summary found in the returns of 1821, published by order of parliament, the sum total at page 32 is 12,218,500 individuals; but in casting up the addition of different counties, the number is found to be 12,220,600 individuals, which latter is the amount we go by.

navigation: I have taken them according to a very valuable official statement, dated September 30, 1821, giving the number of ships registered in each port, their tonnage, and the strength of their crew.

	Coasts	To the East.	To the West.	To the South.	Total.
Ports for registering Ships.	Scotland	16	19	,,	35
	England	19	24	27	70
	TOTAL	35	43	27	105
Ships registered.	Scotland	1,766	1,367	,,	3,133
	England	9,735	4,327	2,953	17,015
	TOTAL	11,501	5,694	2,953	20,148
Tonnage of these ships.	Scotland	170,513	117,557	"	288,070
	England	1,454,988	421,525	177,419	2,053,932
	TOTAL	1,625,501	539,082	177,419	2,342,002
Crews.	Scotland	12,135	8,325	,,	20,460
	England	90,215	25,140	12,843	128,198
	TOTAL	102,350	33,465	12,843	148,658

According to these first data, I conclude that there are, in Great Britain, to *one million* of individuals, inhabiting the basins which belong to the

	Coasts	To the East.	To the West.	To the South.	Total
Ships.	Scotland	1,416	1,538	,,	1,468
	England	1,492	998	2,311	1,384
Tons.	Scotland	136,809	132,257	,,	134,915
	England	219,789	97,499	138,874	168,086
Seamen.	Scotland	9,736	9,354	,,	9,582
	England	13,628	5,816	10,055	10,490

Thus, a million of inhabitants of Great Britain

possess, upon a mean proportion, 1400 ships, measuring 163,139 tons, and manned by 10,368 seamen. In treating of the foreign trade of England, we shall present many important consequences deduced from these statistic data.

END OF THE SECOND VOLUME.

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